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BROOKLYN BOTANIC GARDEN RECORD

PLANTS & GARDENS

FRUITS IN THE HOME GARDEN

SPRING
1961

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SERIES
NO. 1

AMONG THE CONTRIBUTORS TO THIS ISSUE

JOHN S. BAILEY, associate research professor of pomology, University of Massachusetts, Amherst, Massachusetts.

HERBERT C. BARRETT, assistant professor, Department of Horticulture, University of Illinois, Urbana, Illinois.

KARL D. BRASE, associate professor of pomology, New York State Agricultural Experiment Station, Geneva, New York.

REID M. BROOKS, pomologist, College of Agriculture, University of California, Davis, California.

ERNEST G. CHRIST, extension specialist in pomology, College of Agriculture, New Brunswick, New Jersey.

GEORGE M. DARROW, retired, formerly principal pomologist, Plant Industry Station, United States Department of Agriculture, Beltsville, Maryland.

JOHN EINSET, professor of pomology and head of department, New York State Agricultural Experiment Station, Geneva, New York.

EUGENE GRIFFITH, Crops Research Division, A. R. S., United States Department of Agriculture, Glenn Dale, Maryland.

DONALD F. JONES, retired, formerly geneticist, Connecticut Agricultural Experiment Station, New Haven, Connecticut.

LAWRENCE H. MACDANIELS, retired, formerly head of Department of Floriculture and Ornamental Horticulture, Cornell University, Ithaca, New York.

JOHN ROBERT MAGNESS, retired, formerly principal pomologist, United States Department of Agriculture; presently editor of Proceedings of the American Society for Horticultural Science.

E. FRANK PALMER, retired, formerly director of the Horticultural Experiment Station, Vineland Station, Ontario, Canada.

WILLIAM H. PRESTON, JR., horticulturist, Crops Research Division, A.R.S., United States Department of Agriculture, Glenn Dale, Maryland.

GEORGE L. SLATE, guest editor of this issue, professor of pomology, Department of Pomology, New York Agricultural Experiment Station, Geneva, New York.

EDWARD H. SMITH, professor of entomology, New York State Agricultural Station, Geneva, New York.

C. R. URE, head, Fruit Crops Section, Experimental Farm, Research Branch, Canada Agriculture, Morden, Manitoba, Canada.

ROGER D. WAY, associate professor of pomology, New York State Agricultural Station, Geneva, New York.

H. S. WOLFE, professor and head of department, Department of Fruit Crops, University of Florida, Gainesville, Florida.

PLANTS & GARDENS

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Editorial

GEORGE M. SLATE, *Guest Editor*

PETER K. NELSON, *Associate Editor*

and the Editorial Committee of the Brooklyn Botanic Garden

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Rock

Strawberries, and dwarf apple and peach trees in a garden that is both utilitarian an attractive

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES
BROOKLYN BOTANIC GARDEN
1000 WASHINGTON AVENUE
BROOKLYN 25, NEW YORK
TELEPHONE: MAIN 2-4433

Spring 1961

FRUITS VS. ORNAMENTALS. We talk and write of fruit-bearing shrubs and trees as if they were in another world from the ornamentals. As a matter of fact, this entire Handbook deals with those thrifty members of the plant kingdom that have been bred to store their wares in the form of choice fruits for the use of man. The very thought of a crisp apple, a mellow pear or seedy but flavorsome berries of many sorts—and our instincts say . . . "plant the fruit-bearers." But a point easily missed is that the fruit-bearers can also be choice ornamental plants. Apple trees, for example, may fall a bit short of the dramatic beauty that characterizes some of the handsome but fruitless ornamental cherries, but their climatic range is far greater, their trunks far handsomer—and what could be more fascinating than watching the tiny green apples grow through the season into colorful and delicious fruits? Peaches and blueberries come in the same category of ornamental trees and shrubs that are also fruitful. Both are attractive for their flowers and fruit, and in autumn blueberries are among the handsomest of shrubs for their foliage color.

FAMILIES OF PLANTS. Here is another idea to contemplate. Of all the great families of plants, the Rose Family probably includes the greatest number of edible fruit-producing species and they grow in both warm and cold temperate climates (apple, apricot, cherry, plum, quince, raspberry, strawberry and many others). Yet the Rose Family also includes some of the fine plants that qualify only as ornamentals (rose, hawthorne, spirea, cotoneaster, firethorn, flowering crab apple, flowering quince.)

The Rue Family of tropical and warm temperate climates includes orange, grapefruit, tangerine, lemon, etc. Only one of its ornamental members, the so-called hardy orange *(Poncirus trifoliata)*, grows in cold temperate regions where its spiny branches bear an almost solid mass of fragrant white blossoms in spring and rather attractive toy-size but inedible oranges late in the season.

ORIGIN. Where have our cultivated varieties of fruits come from? The answer is that temperate America gave the world the wild prototypes of the modern strawberry, blueberry, blackberry, black raspberry and some of the grapes and plums; and from southeastern Europe and southwest Asia came the wild forebears of apple, pear, cherry and some of the grapes. Asia gave us the peach, apricot and certain of the plums.

Present-day varieties are hundreds of years away from their wilding ancestors. Man has tested chance seedlings over the centuries and from such sources have come well-known varieties. For example, the Rhode Island Greening apple has been known and grown for more than two centuries, the Northern Spy for a century and a half, and the McIntosh for some 90 years. Plant breeders in the various State Experiment Stations (amateurs, too) have produced many new varieties of grapes, peaches and pears. And new varieties of strawberries, peaches and raspberries come along so fast that a once-popular type may be forgotten in a decade.

Now a word of well deserved thanks: To Editor Slate and his corps of experts, we owe our grateful appreciation. Their knowledgeable counsel is to fruit growing what the needle is to the compass!

Sincerely,

George S. Avery

Director

McFarla

Strawberries growing in a corner of the vegetable garden

THE PLEASURES OF THE FRUIT GARDEN

E. F. Palmer

A FRUIT garden (indeed any garden) is a pleasure to me, as I hope it is or will be to anyone who reads my comments here. It needs to give pleasure, for almost certainly one can buy fruit cheaper, in terms of dollars, than one can produce it in his own garden; that is, if one puts a dollar value on his labor. Also, more likely than not, the home fruit grower will end up by producing more fruit than one family reasonably can be expected to eat.

So you'll be giving fruit away. That is part of the pleasure of fruit gardening. Another, and most important, is having what you want when you want it, fresh, "tree" ripened, top quality things you just can't buy. There is pleasure, too, in the inward satisfaction, the sen of accomplishment in making a wort while contribution to the family diet. Th is part of one's reward for the work ar care required to grow *good* fruit.

For quality, everyone knows appl and pears in the market place. Comme cial cherries also can be reasonably goo though often not fully mature. But t peach one buys just doesn't rate. N usually. You'll know if you ever gro your own. And have you ever eaten, cooked, a tree-ripened plum or prun Little wonder that from the market t fruit is in low esteem. Like the peac the commercial plum is marketed t soon, too green.

Gardening, too, is a relaxing occupation, reward enough in itself. Any kind of gardening. What is there to equal it in easing the workaday tensions? So, plan to extend your gardening activity by adding unto it fruit—strawberries, raspberries, blackberries, currants and gooseberries; and blueberries maybe, if you have the right conditions or can approximate them. Also, dwarf tree fruits if space permits and you are prepared to cope with the pests that tree fruits are heir to. It may be necessary to forego tree fruits, even dwarfs, if space is at a premium. But grow them if you can. You will be richly rewarded.

For other than tree fruits the needs of the family require few plants, little space. Our own garden has exactly three bushes each of gooseberries, red currants and black currants, plenty for at least two or three people. A larger family will require proportionately more—except black currants! The crop from one husky bush will likely suffice for both you and your next-door neighbor. Not that it isn't a fine fruit. It is. But it's a powerful fruit, needs "dilution" in processing, whether for jam or other purposes. But, if your state laws will permit, grow black currants, for they are quite worth while, and very high in vitamin C. (The culture of black currants is prohibited in the United States, but they may be grown in Canada.)

A 30-foot row supplies all the strawberries, and more, than we can use, fresh and processed. Raspberries the same. Blueberries? I wouldn't know, as my soil conditions are not at all to their liking. But I would surely grow them if I could and I may yet try. Likely a half-dozen plants would supply our needs in season and for freezing.

The lowly gooseberry may not have very warm appeal. The small-fruited varieties, picked green and puckery, are pretty miserable food even when well sugared. But in your own garden you can grow the large-fruited English varieties, and let them really mature before using them in pie, or jam, or stewed as a dessert. The "green" gooseberry just isn't in the same league. Even the small-fruited varieties are worth while when fully mature. Try eating fully ripe gooseberries out of hand as they do in England, where they "understand" the gooseberry; treat it as an equal (among fruits), thorns and all.

Be choosy as to the varieties you grow of the various fruits. Place quality first rather than yield and appearance which the commercial grower must do. The home garden is for home varieties. Of course, a good commercial variety may be quite acceptable as to quality, but it isn't always so. In any event, get the best local state advice, as varieties suitable in one region may not be at their best in another.

In my fruit garden, as elsewhere (perennial borders, lily beds, shrubberies) I mulch rather than cultivate. The various plants like it—a cooler moister soil—and I like it, as it cuts down on toil and sweat. Energy can be saved for more productive garden purposes.

What one may use for a mulch is pretty much what is locally available: cut straw, leaf mold, sawdust, shavings, peat, etc. I use spent mushroom compost and like it very much indeed. As I write this in mid-May everything is growing but the weeds. They're fairly well smothered, just a little hand weeding here and there, now and then. And that's the way it will be well on in the year. By late fall there will be little left of the original 2- to 3-inch compost mulch. Of course, some mulch materials will last from year to year; or you may maintain a mulch which decomposes readily, by occasional additions. And if, sometime before winter sets in, you feel the urge to fork over the garden, go ahead! It's good exercise even if unnecessary or perhaps even undesirable.

Another thing, and having partly in mind that a maintained mulch for bush and cane fruits does away with the need for cultivation, you can "scatter" the fruit plantings. No particular need to concentrate them in one part of your total garden area especially if space is at a premium. For example, gooseberries prefer a bit of shade. A few bushes can

be placed in some odd shady corner quite apart from your main "kitchen" garden. Red and black currants do best with a little shade too, but less than for gooseberries. Full sun is best for raspberries and blackberries, and certainly for strawberries.

In fact, there is no real need to be a purist when planning your garden—fruit here, vegetables there, flowers elsewhere. At least that's my view, although I expect to be taken to task for it. What I try to do is make the best possible use of the area set aside for the kitchen garden. As of now it contains, in suitable but not segregated arrangement, the following items: one row (shady side) of currants and gooseberries; next, two rows of narcissi and tulips for cutting; then two rows of small lily bulbs that are growing into big ones (nursery); several rows of sundry vegetables; single rows of strawberries, asparagus, and raspberries in that order. Finally, three rows of lilies grown from seed. Scattered around the periphery are a cold frame, rhubarb, odds and ends of nursery items, a hill or two of cucumbers, melons and squash, some surplus rose bushes, a few shrubs. And, if and when I think of something else for which I feel a need, I'll find a place for it. It might be blueberries, or even horseradish!

I enjoy my kitchen garden, fruit and all, however some may view as odd the things I do. My only admonition is that if aesthetic appearance is of little concern to you, just make the best possible use of your garden area, and *enjoy yourself*. In fact, if the garden, including the fruit garden, isn't a pleasure to you, then it's a losing venture. The supermarket has what you want.

Raspberries and other small fruits can be successfully grown in combination with vegetables

McFarland

PLANNING FOR THE FRUIT GARDEN

Ernest G. Christ

GROWING fruit in the home garden should be considered a means of relaxation or somewhat of a hobby rather than a production enterprise. A few fruit plants grown well will provide much the same enjoyment one realizes from ornamental plants, but in addition a variety of interesting fruits are produced. If fruit production is the main purpose, it no longer is a means of relaxation, but instead it becomes a real chore. The comments to follow are for the amateur gardener who grows fruit for fun with a minimum amount of work but good fruit production.

In planning for fruit growing one must consider several fundamentals or requirements. These include adequate space and sunlight and a reasonably fertile soil. The selection of recommended varieties, good nursery stock and careful consideration of pollination of the tree fruits are also important.

Space and Sunlight

All fruit plants grow best in full sunshine. They will not grow vigorously nor produce maximum quantities of fruit when grown in partial shade. The space available in full sunshine determines the size of the fruit planting. On a small property one must limit the fruit planting to small fruits including strawberries, brambles, and perhaps blueberries. Grapes require more space and a trellis of some sort and tree fruits also require more space.

The standard size apple, pear, and sweet cherry trees have no place in the home fruit planting because of the difficulty in pruning, spraying and harvesting. We discourage planting standard size fruit trees and highly recommend the dwarf fruit trees.

Fertile Soil

Fruit plants grow best in a soil that is well drained but not excessively drained. Fruit plants will not tolerate a soil that is poorly drained and remains waterlogged after a heavy rain. Infertile soils can be improved through the use of fertilizers and mulches but an excessively wet soil is difficult to correct.

All fruit plants except blueberries grow best in a soil that is just slightly acid (pH 5.5 to 6.5). Blueberries thrive in a soil that is more acid (about pH 4.8 to 5.0). Most eastern soils require the addition of lime to maintain the proper acidity.

Fruit Varieties

The selection of varieties varies from one state to another to some extent, however there are many varieties of fruits that are adapted to a large area including the entire Northeast and a few even more extensive. For example, the 'Catskill' and 'Sparkle' strawberry, the 'September' and 'Latham' red raspberry, the 'Concord' grape, the 'Elberta' peach, the 'Delicious' apple and the 'Bartlett' pear. There are other varieties with equally wide adaptability but there are some with

McFarlan

'Hale' peach, a commonly grown peach which needs another variety growing with it t
insure pollination

limited range and because of these differences, one should check local recommendations from those who know.

Nursery Stock

Fruit nursery stock varies in quality as much as ornamental planting stock. For example, strawberry plants that a essentially free of virus diseases are avai able from many nurseries and should b planted rather than ordinary stoc Bramble plants can be certified, or the can be quite ordinary and contaminate with virus diseases. It is best not to us plants from your neighbor even thoug

he means well and is trying to save you some money. Such plants are quite likely to have virus diseases, so start with certified stock from a reputable nursery. Don't get too excited over the nursery tree that is of bearing age. The 1- and 2-year-old tree or grape plant is best. Don't buy the 3- and 4-year-old "bearing age" plant. The digging, pruning, and transplanting will set it back and no time will be gained.

Pollination

Small fruits, including strawberries, brambles, blueberries and grapes are considered self-fruitful generally and do not require cross-pollination. As a result, one need not be concerned about pollination from this standpoint. Warm, sunny weather with bee activity during bloom will result in a good set of fruit.

Many tree fruit varieties are self-unfruitful and require pollen from another compatible variety during the blooming period. The absence of cross-pollination is often the reason for a poor set of fruit after a satisfactory bloom. Several conditions are necessary to obtain satisfactory cross-pollination. Varieties must be compatible and bloom together, or the blooming periods must overlap. Varieties must have viable pollen. Varieties must be near each other and bees must be present during the blooming period. Weeds, such as dandelion, mustard and wild radish, should not be present in large numbers since their flowers will lure bees away from the fruit blossoms.

Apples and Pears

All apple and pear varieties require cross-pollination to set a good crop of fruit. Several of the more common apple varieties with satisfactory pollen are 'Delicious,' 'Early McIntosh,' 'Grimes Golden,' 'Jonathan,' 'Cortland,' 'McIntosh,' 'Golden Delicious,' 'Rome,' 'Lodi' and 'Wealthy.' Several apple varieties produce unsatisfactory pollen; a few common ones among these are 'Gravenstein,' 'Baldwin,' 'R. I. Greening,' 'Stayman,' 'Winesap,' 'Paragon' and 'Turley.' If any of the varieties with unsatisfactory pollen are planted, two more varieties with good pollen are needed. For example, 'Delicious will pollinate 'Stayman,' but a third variety is needed to pollinate 'Delicious' because 'Stayman' pollen is not viable.

Two pear varieties that are not compatible are 'Bartlett' and 'Seckel.' A third variety is required if these two are planted.

Peaches and Nectarines

Most peach and nectarine varieties are self-fruitful. The variety 'J. H. Hale' is the most common self-unfruitful peach.

Plums

Japanese plums bloom earlier, ripen earlier, and are more sensitive to cold than the European varieties. Most are self-unfruitful and require cross-pollination. 'Methley' has produced good crops with no pollinators nearby, but even for this variety one should provide cross-pollination.

Some European plums are self-fruitful and some are self-unfruitful. All European varieties will set better crops of fruit if cross-pollination is provided. European varieties pollinate only European varieties. They will not pollinate Japanese varieties.

Cherries

All sweet cherries are self-unfruitful and require cross-pollination to set a good crop of fruit. 'Bing,' 'Lambert,' and 'Napoleon' ('Royal Anne') will not pollinate each other.

The important sour cherries are self-fruitful and do not require cross-pollination. Sour cherries bloom too late to be dependable pollinators for sweet cherries.

Birds

In the overall planning, one must consider bird feeding as a major threat to some of the fruit crops. Two of their favorite fruits include cherries (mainly sweet) and blueberries. Birds will harvest the entire crop most years. Because of this, sweet cherry trees are not a good choice for the home garden and blueberry plants must be covered during fruit ripening.

'Catskill,' a strawberry popular in the Northeast

STRAWBERRIES IN THE HOME GARDEN

John S. Bailey

THE strawberry is the easiest and most satisfactory fruit for the home gardener to grow. Under good growing conditions 2 feet of row will yield a quart of berries, or a quart of berries for each original mother plant set. The strawberry will grow on a wide variety of soils, is not fussy about soil acidity, occupies the soil for a relatively short period, ordinarily requires a minimum of pest control, and no special equipment is needed.

A good start can save a lot of time, trouble and disappointment. Get clean, healthy plants of a good variety. Set them carefully in fertile, well prepared, disease-free soil where spring frosts w not be a serious problem.

Soils

The strawberry plant grows best in sandy or gravelly loam but will thrive light sandy types to heavy clay loan Very dry gravelly or very wet heavy so are to be avoided. The soil needs to well prepared, a year in advance if po sible, by plowing and harrowing, rot tilling, or spading. Organic material su as lawn clippings or composted leav and grass, thoroughly worked into t soil, helps to enrich it. A green manu

crop of rye grass can be sown in early fall and turned under in the spring before planting. It furnishes much organic matter but must be mowed or turned under before it goes to seed or it will become a serious weed. Farm manures are the best soil builders. Stable manure at 2 to 4 bushels per 100 square feet or poultry manure at half this rate is excellent. Several kinds of dried manures are usually available at garden supply stores. These are good but expensive. In place of manure a garden fertilizer, such as 5-8-7 or 5-10-5, at 4 to 5 pounds per 25 feet of row may be used. If the soil is well prepared and sufficiently enriched before the plants are set, no more fertilizer will be needed before a crop is harvested.

Varieties

The list of varieties available is long. Each is adapted to a particular region so it is wise to take the advice of your state experiment station as to choice. In general, 'Blakemore' is most popular in the Southeast, 'Howard' ('Premier') and 'Catskill' in the Northeast, 'Marshall' and 'Northwest' in Washington and Oregon, 'Shasta' and 'Lassen' in California, 'Missionary' and 'Florida Ninety' in Florida, and 'Klonmore' and 'Klondike' along the gulf coast of Louisiana, Mississippi, and Alabama.

Planting

It is extremely important to get clean, healthy plants for setting because some very serious disease and insect pests can be carried in or on the plants. Especially serious are viruses, several root diseases, and cyclamen mites. Buying plants from a reputable nursery is much safer than getting them from a neighbor. Several states have strawberry plant inspection and certification service. Where this is available it will pay to buy the best grade of plants.

Early spring planting in most sections is better than planting later. Strawberries had best not follow strawberries. Because of a serious soil-borne disease, they

Pyramidal bed, a method of growing strawberries where space is limited

Marking off rows with guide stakes and board in prepared soil of strawberry bed

should not be planted following tomatoes, potatoes, eggplant, or raspberries. Set the plants deep enough so that no roots are exposed but not deep enough to bury the crowns. Firm the soil well around them. Where the soil has been rototilled, the plants will need to be set somewhat deeper or the roots will be exposed when the soil settles.

There are several planting systems. Growing in a matted row is the easiest in the home garden. The plants are set 2 feet apart in rows 3½ to 4½ feet apart. The runner plants are then allowed to fill in the row. Runner plants which develop after the first of September are of no value and may be discarded. It is best not to let the rows get too wide. Two or three feet is wide enough if easy picking is desired.

If a maximum crop of extra large, t quality berries is desired and extra ti and effort are not objectionable, a hill a spaced row system may be used. F the simplest kind of spaced row reta only the early formed runner plants a space them 7 to 9 inches apart arou the mother plant. For the hill system t plants are set 18 x 18 inches in beds thr or four rows wide. All runners are r moved and only the mother plants a allowed to develop and bear fruit.

For a large crop of berries, good ca the first year is vital. Regular weedi and cultivation are a necessity. Althoug there are chemicals for weeding, the h and the cultivator are still the surest a safest. Weeds don't take summer vac tions. If they are not kept in check, t growth of the strawberries may be r duced and the removal of big weeds c

Gantner photos

Plants are spaced in marked rows. Roots are spread out and plants set with crowns at but not below soil level

Bed is kept clean by careful hoeing

Weeds close to strawberry plants are best removed by hand to avoid injury to plants

Removing blossoms first year stimulates more vigorous growth of plants, insures better crop second year

seriously disturb the strawberry plant's root system.

Blossom removal, another important first year operation, can be done when hoeing the bed. If the plants are allowed to bear fruit the first year, their vigor is reduced and the main crop the second year will be smaller.

Lack of soil moisture during the first year can seriously retard growth and reduce yield. Watering during dry spells so as to provide the equivalent of ¾ to 1 inch of rain a week will insure against moisture deficiency.

Winter Care

In the North the strawberry plant needs protection against winter cold. This is provided by applying 3 to 4 inches of mulch in the late fall after the plants have become dormant but before the ground freezes solid. Straw is the most satisfactory material because it is easily obtained. Pine needles are good if available. Sawdust or shavings can be used in protected locations where they will not be blown away.

The following spring, when the new leaves start to develop and turn yellow, is the time to remove the mulch. Leaving about an inch helps to keep the berries clean. The plants will easily grow through this thin layer. If the excess is left between the rows temporarily, it can be replaced when needed for frost protection.

Pests

Some growers fertilize the bed in the spring of the bearing year. This practice is questionable. Although it increases the

Plants are mulched with sawdust or straw for winter protection and to keep down weeds. Sawdust should be used only where winds will not blow it away

Gantner photos

Gantne

Aluminum foil plates suspended over plants may help frighten off birds; wire net give more positive protection

size of berries, it also makes them softer and increases loss from fruit rots in a wet season.

Several of the worst pests of the strawberry can be brought in on the plants. This makes it extremely important to get plants that are disease- and insect-free to start the bed. There is little the gardener can do about these plant-borne pests or about soil-borne diseases once the plants are set.

The grubs of the June bug or the Japanese beetle sometimes eat the roots of strawberry plants, particularly if they are set following the plowing of sod. Grub proofing the soil with aldrin, dieldrin, or chlordane will prevent this type of injury. The two-spotted mite, a sucking insect which attacks the under side of leaves, can be controlled by spraying or dusting with malathion. The loss of berries by fruit rots can be reduced by regular sprays or dusts of captan. Several "all-purpose" dusts and sprays which will control most of the common pests are available. Your state experiment station can supply the best information on local pests and their control.

If the bed is to be fruited more tha one year, renovation after harvest will in crease the following crop. The plant top are mowed, dried, and burned. The mothe plants are removed. The bed is thorough ly weeded, the strawberry plants thinned and the bed given an application of ferti lizer.

Everbearing Strawberries

Everbearing strawberries are more dif ficult to grow than ordinary varieties They require a more fertile soil, mor care, and bear smaller crops. Since many of them produce few runners, they are usually grown by the hill system. A 3 inch mulch of sawdust is needed to reduc soil water loss because the everbearers fruit in a hot, often dry, part of summer Watering is more likely to be needed than with June-bearing varieties. The blos soms are removed till mid-July to elimi nate the spring crop and increase the summer crop. Everbearers are usually fruited only one year. The most common varieties are 'Gem,' ('Superfection,' 'Brilliant'), 'Red Rich,' and 'Twentieth Century.' Two new varieties, 'Ozark Beauty' and 'Ogallala,' look promising.

THE BUSH FRUITS, WITH AND WITHOUT THORNS

Donald F. Jones

SOME kind of bush fruit can be grown in nearly every part of the United States. The right varieties in good locations produce delicious fruit year after year with very little attention. Well ripened fruit picked fresh from the garden has qualities that cannot be purchased in any store.

Now that we have put the barbs on the wire fences we don't need them on our cultivated plants. Unfortunately few satisfactory varieties that are completely thornless have been developed so far but plant breeders are working on them and improvements are being made. Most varieties of red raspberries have such small and flexible thorns that they can be handled easily with good leather gloves. Black raspberries and blackberries are less removed from the wild state.

Culture

These perennial bushes are best grown in the home garden by some system of mulching. Either a litter mulch or a lawn grass sod mulch is satisfactory. Poles or trellises are advisable to hold the plants in place, to reduce wind damage and to provide for easy picking. Plants that sprout from the roots must be restricted in their growth. If not controlled, a bramble patch soon becomes a jungle that is impossible to manage. A strip of heavy roofing asphalt paper on each side of the row covered with mulching material is the most satisfactory method of keeping the sprouts in the row. A heavy mulch of leaves between the rows will also discourage most of the sprouts.

The shoots can be tied to stakes set 2 to 3 feet apart in the row but a wire trellis is usually more satisfactory. One wire will do, placed 4 to 5 feet above ground. The new shoots are tied to this wire as soon as they are tall enough. Two or three wires are better, fastened to strong posts not more than 10 feet apart in the row, with the rows 8 feet apart. The first wire should be about 18 inches above the ground and the top wire 5 to 6 feet. This will hold the new shoots as they grow and keep them out of the way of the pickers.

The old canes should be cut out as soon as they are through fruiting. This is not essential, as they can be left until the leaves are off in the winter; but the new growth will be less shaded and insects and diseases are easier to control if the old stalks are removed as soon as possible.

Spraying or dusting for leaf- and fruit-eating insects is usually necessary. In the humid parts of the country mildew

Frese

Raspberries grown in rows and trained to horizontal wires are easy to care for and harvesting is simple

Gantner

Old raspberry canes are best removed when fruiting season is over

on the leaves and fruit is the worst disease to contend with. Applications of a good fungicide when growth starts in the spring and before the fruit starts to ripen are advisable. Good air drainage will also reduce mildew damage. Avo morning shade if possible. Tender frui such as raspberries like a little afterno shading but cannot contend with tr roots in the soil.

Berries of all kinds need water regular intervals, especially while t fruit is ripening. Never let the plan go more than a week without rain irrigation. Litter mulching will help conserve moisture in the soil. A law grass or clover sod mulch must be ke closely clipped and well fertilized an watered at all times during the growin season.

Winter Care

Most of the red and purple raspberri and blackberries are winter hardy bu below-zero temperature often injures th plants even if they are not killed outrigh Most growers lay the canes on the groun by tying them to stakes or adjacent plant at their base, and cover them with leave or hay. This is done shortly before th ground begins to freeze. Keep this cove on as long as possible in the spring, un covering the plants gradually as the bud begin to open. By keeping the plant

Red raspberries, a favorite small fruit

Roche photo

Blackberries properly grown are heavy bearers

McFarland

Gooseberry bush trained on horizontal wires

covered as long as possible flowering can be delayed so that there is seldom any frost damage to the fruit buds.

Varieties

Red raspberries grow best in the northern states and Canada if protected over winter. They are also grown in mountain regions farther south. There are fall-bearing varieties of which 'September' is the most widely planted in the Northeast. These bear fruit in the spring and fall. However, there are so many good fruits in the fall that berries are not appreciated then as they are in the spring. 'Newburgh,' 'Taylor,' 'Milton,' and 'Latham' are the varieties most generally grown in the eastern states. 'Puyallup' and 'Canby' are varieties especially selected for the Northwest. 'Early Red' is recommended for the north central states. 'Marion' and 'Sodus' are the best of the purple-fruited sorts.

Black raspberries grow best in the central states where the summers are dry and warm and the winters are not too severe. The stiff canes of the black raspberries cannot be laid down for winter protection as easily as the red raspberries or the dewberries.

Blackberries, dewberries, and **boysenberries** and similar types are the most delicious of all berries when well grown and thoroughly ripened. Blackberries are not ripe when they first turn black. They must stay on until they drop with a slight touch. Unfortunately their rampant growth, vicious thorns and the fact that they cannot be easily protected from birds, who also like the fruit, discourages their use. The new varieties such as 'Darrow' and 'Bailey' are much better than the older varieties for the Northeast. 'Flordagrand' is a new variety for central Florida and possibly other southern regions.

Currants, gooseberries, and **blueberries,** where they are adapted, are easily grown and should have a place in most home fruit gardens.

BLUEBERRIES IN THE HOME FRUIT GARDEN

George M. Darrow

IN 1938 I visited the blueberry planting of Mr. and Mrs Dirks in western Massachusetts. Their garden was larger than most blueberry plantings. It was started about 1924 and was as fine as ever when I saw it again in 1949. The planting is on sloping upland near the Dirk's home, and for 25 years has been mulched with sawdust. Additional sawdust is applied every few years to keep down grass and weeds. A frame has been built which is covered with tobacco cloth during the ripening season to keep out birds.

Mulching

In general in the eastern United States the two practices most necessary for the success of home blueberry gardens are just the two used by th Dirks—mulching with sawdust (o leaves) and covering to keep out birds In my own garden in Maryland I us leaves, wood chips, and sawdust fo mulch—leaves as far as they go, an wood chips and sawdust for the re maining bushes. Where quack grass o strong perennial weeds might com through the mulch, I first put dow heavy wrapping paper or cardboard an then use the leaves and sawdust on to of it. I have used any kind of leave available—bamboo, black walnut, apple mulberry, and others. The wood chip are from the telephone company prun ers; and sawdust I get from a nearby

sawmill. The leaves are piled deeply enough to smother grass, and the wood chips and sawdust about 6 inches deep over the whole surface.

Soil

Though the ideal soil for blueberries is a loose sand-peat with some field soil mixed in, most soils of the states along the Atlantic Coast can be made satisfactory. A possible exception is a soil mixed with plaster and lime near a building. In that case a hole at least 2½ feet square and 1½ feet deep should be dug and filled with acid woods soil or with baled peat or sawdust mixed about half-and-half with good soil.

A good blueberry soil should be quite acid (pH 4.0 to 4.8) and contain at least a fair amount of organic matter. If it tests less acid (pH 5.0 to 5.5), regular applications of sulfate of ammonia usually will result in healthy growth. If the soil is only slightly acid (pH 5.5 to 6.5), powdered sulfur should be spread over a 3-foot circle where each bush is to be planted and mixed well in the upper 10 inches of soil. On light soils about 2 pounds of sulfur, and on medium loams 4 pounds, will be needed for ten plants. For good yields, blueberries should not be in the shade.

Planting and Fertilizing

Two-year-old plants are usually best for planting; strong 2-year plants should be about 15 inches high. They are usually set in early spring, as soon as the soil can be prepared; but from southern Connecticut southward it is usually better to plant in October or November. The bushes should be planted about 6 to 8 feet apart. After the bushes have started growth, a mixed garden fertilizer can be spread in a band 6 to 12 inches from the plant the first year, and in a wider band as the bushes grow older. About 1 ounce of fertilizer per plant is used for each year of age up to 8 years. After the first year fertilizer is applied twice; the mixed garden fertilizer in April as the buds start, and ⅓ pound of ammonium sulfate for each bush about June 15. If a 6-inch-deep mulch of sawdust is used, twice as much fertilizer should be used as on unmulched beds. If leaves are used as mulch, one and one-half times as much fertilizer for a 3-inch layer of leaves (after they have packed down) should be enough.

The plants should make a good growth the first year, often 6 to 12 inches. They should bear a small crop the third year and a larger crop each year thereafter. When full-grown they are usually 6 to 8 feet high and about 6 feet wide.

Varieties

It is a little over thirty years since blueberry culture first became successful. About 1909 the late F.V. Coville and Miss Elizabeth White began searching the wild for the best native bushes. The selected bushes were propagated and about 1918 the first shipments were made from a cultivated field at Whitesbog, New Jersey. Breeding work was started in 1909 and in 1920 three varieties resulting from this work were named and introduced. Thirty highbush varieties from Coville's breeding work and six rabbiteye varieties from the writer's work have now been named, the later named varieties replacing the earlier ones. Extensive breeding is still being carried on and new varieties can be expected—better in flavor, size, color, productiveness, hardiness, or in season of maturing.

The home gardener has a goodly number of varieties from which to choose. For two persons, two plants each of three varieties may be enough, or for four persons two each of five kinds. At least two varieties should be in every planting to provide for cross-pollination.

From near New York City south to Virginia, varieties to be considered, listed in order of their ripening are: 'Earliblue,' 'Blueray,' 'Berkeley,' 'Herbert,' and 'Coville'. Fruit of 'Berkeley' is the lightest in color and mildest in taste. 'Coville' is the most tart and the latest to ripen. 'Herbert' has the highest aroma and is the largest. 'Blueray,' 'Herbert,'

McFarlan

Horizontal bar permanently installed over blueberry bushes will support net which is sprea over them to protect berries from birds during fruiting season

and 'Coville' are especially fine for freezing, but the others are very good also. All five of these varieties have vigorous bushes. In the vicinity of Brooklyn 'Earliblue' begins to ripen about July 1, and 'Coville' about August 1, producing through August.

In North Carolina, 'Wolcott' and 'Jersey' are good home garden varieties. From eastern North Carolina south to northern Florida and west to Louisiana, the rabbiteye, a southern blueberry species (*Vaccinium ashei*), is especially adapted to home gardens, for it is much more drought- and heat-resistant an more vigorous than the northern high bush species (*V. corymbosum* and *V. australe*). 'Callaway' and 'Tifblue,' ar the best-flavored of the rabbiteye varie ties, but 'Homebell,' 'Garden Blue,' an 'Mendito' are also good. As for norther varieties at least two varieties should b planted for cross-pollination.

Harvest

For bird control, covering the bushe with tobacco cloth or the new plastic coated paper netting is generally mos

satisfactory. Some growers have built permanent wire net (1-inch mesh) cages to enclose their blueberries. Other methods to keep birds away have been tried with varied success—mouse traps, toy snakes, highly polished metal strips, colored plastic strips like those used at gas stations, or inflated paper bags hanging from cords strung over the bushes. Also tried have been stuffed owls or live hawks tethered to posts, firecrackers, and automatically discharging acetylene guns. Birds soon get used to these devices and continue to eat their favorite food—blueberries. Catbirds near the house and robins farther afield are generally the most destructive; but brown thrashers, cardinals, mocking birds, starlings, and many others take their toll of fruit.

Full-grown bushes, eight or more years old, may bear eight to ten quarts of berries each. Even higher yields can be obtained. In the North, unpruned bushes may bear more than pruned ones. However, the berries on unpruned bushes are relatively small. Light pruning, taking out the small slender branches and leaving the strong ones, is considered best. Farther south, pruning of the high-bush varieties is essential, for unpruned bushes may set so heavily that a great many of the berries do not ripen normally and large parts of the bushes die.

The blueberry lends itself well to plantings near the home, for it is attractive the year through. In May the bloom is pinkish white, in the fall the leaves turn reddish, and in the winter the red and green twigs and red buds are attractive.

Handsome blossoms and bright autumn foliage make blueberries ornamental as well as useful

Roche

CURRANTS AND GOOSEBERRIES ARE GOOD GARDEN FRUITS

George L. Slate

CURRANTS and gooseberries are rarely grown now in gardens, or commercially, although at one time they were grown extensively in the northern states. Yet they are easily grown and can make a substantial contribution to the family diet. For the amount of space they occupy, and the small amount of care required, they are one of the best home garden fruits. Both may be eaten fresh, but their greatest usefulness is in the kitchen.

Currant jelly is one of the best and currant pie is another delicacy rarely seen. Gooseberries make very good jelly, jam, and pie. Green gooseberry pie and sauce are made from the half-grown berries, the premature harvesting serving to thin the crop so that the later berries are larger.

Black currants may not be grown in the United States as they serve as hosts for one stage of the white pine blister rust. Since the white pine is a valuable tree and black currants are of minor importance, their culture is prohibited to save the white pines. In New England and in the Adirondack and Catskill State Parks red currants and gooseberries are also prohibited.

Climate and Soil

Currants and gooseberries require the relatively cool, moist climate of the northern states and do not thrive south of the Potomac and Ohio River Valleys. The plants are the hardiest of our common fruits and are especially useful where many other fruits are not winter hardy.

Medium to heavy soils, fertile and well supplied with organic matter are preferred. Sandy and gravelly soils low in fertility and subject to drought are not suitable for these fruits. The lighter types may be improved with manure, fertilizer, and mulching, and irrigation will improve the moisture supply. Good drainage essential as with most garden plants.

Currants and gooseberries are tolerar of shade and other fruits, and whe space is limited the bushes may be grow between grape vines and small fruit tree However, they should not be grown nea or under large shade trees where roo competition is severe.

Varieties

'Red Lake' and 'Wilder' are standar currant varieties, the former having larg er clusters and being preferred for hom use. 'White Imperial' is the best white fruited variety, but 'White Grape,' is usu ally the variety offered by nurseries.

'Poorman,' red-fruited, is first choic of the gooseberry varieties. 'Downing' i the best green variety. The English o European types are larger-fruited, bu rarely grown as they are susceptible t mildew and require spraying. 'Fredonia, red, and 'Chautauqua,' green, are goo varieties.

Culture

The plants may be set in the fall, o early spring, the earlier the better as they start growth in early April. In the gar den a spacing of 5 feet between plants is sufficient.

These fruits respond well to mulching as they are shallow-rooted and prefer coo moist soils. Tree leaves are an exeellen mulching material, but sawdust, peat hay, straw, and other materials may b used. Cultivation, if practiced, should b as shallow as possible to avoid root injury.

Stable manure is an exeellent source of nutrients for these fruits, especially on the lighter soils. However, as it is not readily obtained by home gardeners at a reasonable price, chemical fertilizer may

Cultivated gooseberries are a somewhat neglected but worth-while small fruit for home gardens

Red currants may be eaten fresh but are better used in preserves and jellies

Roche photos

be used. The usual garden fertilizer in a 5-10-5 or 10-10-10 formula may be used, but the nitrogen is most apt to be needed and it may be had from ammonium nitrate applied at the rate of ¼ pound to each mature bush. If the 10-10-10 fertilizer is used, two to three times as much should be applied. On light soils potash deficiency may occur. Marginal browning of the foliage is an indication. Sulfate of potash, not muriate of potash (potassium chloride), should be applied if potash deficiency is suspected. Manure and hay are also good for correcting potash deficiency. However, garden soils that are fertile and have been well-fertilized during the previous years of use are not likely to be short of potash.

Pruning

Regular annual pruning is desirable to stimulate vigorous new growth and prevent the bushes from becoming a dense thicket of weak, unproductive canes. Picking is easier, especially with gooseberries, if the bush is not too thick. Pruning is done in the spring before growth starts.

Currants and gooseberries bear their fruit towards the base of 1-year-old wo and on spurs on older wood, the b fruit being borne on the 2- and 3-ye old wood. During the first two or th years the only pruning needed is the moval of weak, broken and insect-infest canes. It is important to watch for bor which occur frequently in the canes currants. Infested canes should be out and burned to prevent the infestati from becoming serious.

With older bushes the same procedu should be followed, and in addition t older canes and weaker shoots should removed, leaving equal numbers of vig ous 1-, 2-, and 3-year-old canes.

Propagation

Propagation is very simple if ad tional bushes are wanted or the old plan need replacing. In the garden this is ea ly done by layering canes near t ground. In the spring a low-growing ca is partly covered with a mat of leaves a stone large enough to hold it down. T cane will develop roots where it is in co tact with the soil. A year later the root shoot may be severed from the mot plant and moved to a new location.

Gooseberry bush train as a standard

McFarla

NUT TREES FOR THE HOME GARDEN

L. H. MacDaniels

PRACTICALLY everyone who has enough land to develop a fruit garden has an interest in planting trees for their shade and landscape value. For these purposes nut trees deserve special attention, for not only do most of them give satisfactory shade and provide attractive landscape features but they have the additional advantage of furnishing palatable nuts as well. Nut trees are of many sizes with different forms and foliage textures that will fit almost every situation. Many are interesting because they are unusual and because they bear edible nuts that furnish interest and activity for the children of the family in gathering, curing, and cracking them. Certainly greater use of nut trees around the home is to be encouraged.

Climatic Considerations

Nut trees differ greatly in their suitability for different climatic conditions. Some, like the butternut, are very hardy and will grow almost anywhere in the northeastern United States. Some of the hickories share this hardiness. For many nut trees, however, the range over which they will succeed may be limited by low winter temperatures, late spring frosts, short growing seasons, or insufficient summer heat. Areas with less than 150 days between late spring and early autumn frosts are likely to be unsuitable for all but the hardier sorts. Temperatures below −20°F. become critical for some Chinese chestnuts, some Persian walnuts, filberts, and heartnuts. However, these adverse conditions seldom kill the trees and the fact that an occasional crop is lost is not a serious matter when commercial production is not the purpose of the planting.

Plant Grafted Trees

To obtain satisfaction from the nuts harvested only grafted or budded trees should be planted. There is as much difference between a good grafted variety of black walnut, like the 'Thomas,' and the common walnut seedling as there is between a good apple variety, like 'McIntosh,' and an astringent wild seedling. 'Thomas' is a large nut that cracks easily, giving large kernels of good flavor that are easily picked out by hand. By comparison, the nuts of the average seedling are so difficult to crack and extract the kernels that it is not worth the trouble to gather them. Under such circumstances the nuts merely become a nuisance that adds to the work of caring for the yard. Grafted trees are available from nurserymen or, if one is sufficiently interested and skillful, seedlings may be planted in place and grafted to the desired variety after they become established. A possible exception to the superiority of grafted trees for the home planting is the Chinese chestnut which often shows graft failure due to stock-scion incompatibility.

Pollination

Some kinds of nut trees require cross-pollination so that this must be given consideration in deciding what to plant, particularly if space is limited. To provide for this there must be two different varieties or seedlings planted close enough together that pollen from one will be car-

McFarland

Black walnut trees give light shade

Black walnuts in husks on tree

Roche

ried to the other either by wind or insect Often a tree of the same species but different variety, in a neighbor's garde will furnish the needed pollen, otherwis provision for cross-pollination when tl trees are planted must be made. With fi berts, two plants of different varieti should preferably be only a few yar apart. Chestnuts also will do best if tl trees are separated by only about 1(feet. Hickories and Persian walnuts ma bear poor crops unless there are oth varieties growing nearby. Butternuts an black walnuts apparently have no poll nation problem.

The **black walnut** (*Juglans nigra*) an outstanding American tree that grow rapidly to a large size and needs plent of room. As a lawn tree it has the ad vantage of giving high shade that is n too dense to allow a good lawn to gro under it. A large tree will furnish a the nuts that a family can use. It shoul not be planted where the roots will com pete with the plants in the flower c vegetable garden because of the apparen toxicity of its roots to tomatoes and sor other plants. Good varieties availabl from nurserymen are 'Thomas,' 'Ohio 'Stabler,' 'Snyder,' 'Wiard,' 'Elme Myers,' and others.

The **Persian walnut** (*Juglans regia*) c English walnut as it is sometimes errone ously called, made little progress in th northeastern states until hardy form were brought in from the Carpathia Mountains of Poland. Selections fro these original introductions bear nuts c good size and quality and are hard throughout much of the Northeast. Thei chief drawback is that the trees sta growth early in the spring and the ne shoots are killed by late frosts. This doe not occur every year, however, and th trees are sufficiently attractive and th nuts valuable enough to make them wel worth growing. The trees are self fruit ful but growing more than one tree i advisable because the pistillate flowers o a given variety may not be receptiv while the catkins of that tree are shed ding pollen. With a second tree there i a better chance of securing pollinatio

Recommended varieties are 'McKinster,' 'Jacobs,' 'Colby,' 'Lake,' 'Metcalfe,' 'Schafer,' 'Littlepage,' and 'Hansen.'

The **butternut** (*J. cinerea*) is the hardiest of the nut trees, its range extending into Maine and New Brunswick. The nuts have an excellent flavor that is highly prized locally. Grafted varieties are much superior to the ordinary run of seedlings in that usually whole halves of the kernel can be recovered from nuts correctly cracked from the ends. The trees may be short lived under some conditions due to fungus infection. Varieties are 'Craxezy,' 'Love,' 'Thill,' and 'Van der Poppen.'

Closely related to the butternut is the **Japanese walnut** (*J. ailanthifolia*). This is a large, rapidly growing tree with a spreading crown and very large compound leaves that give it a somewhat tropical appearance. The nuts are variable, some of them resembling the butternut rather closely and others somewhat smoother. One selection, 'Mitchell,' has good cracking quality but for the most part they are very hard to crack and lacking in flavor. The **heartnut** is a botanical variety (*J. sieboldiana* var. *cordiformis*) bearing smooth, easily cracked nuts in clusters. The varieties differ somewhat in hardiness. Varieties are 'Faust,' 'Stranger,' 'Walters,' 'Wright,' 'Fodermaier' and others.

The **hickories** (*Carya* spp.) include the **pecan** and a number of species native to the northeastern states. The pecan, native to the South and Middle West, fails to mature nuts in the North because of the lack of sufficient summer heat. The pecan is, however, hardy in the North and makes a good shade tree. Of the other native hickories, the shagbark (*Carya ovata*) is the most valuable for its nuts. The shellbark (*C. laciniosa*), native mostly to the Middle West, is a vigorous handsome tree but for the most part the nuts have thick shells and poor cracking quality. The mockernut (*C. alba*), native to the Northeast, is even less valuable for its nuts. Hickory trees are difficult to transplant and slow in coming into bearing. However, a good grafted hickory tree in

Kittredge

Butternuts in the husk are more elliptical and pointed than walnuts

"Meat" of butternut is rich and oily

McFarland

Branch of sha bark hickory husks drop fro nuts

Kittred

a dooryard is a valuable asset for its shade and fine flavored nuts, and is well worth working for. Varieties are 'Wilcox,' 'Kentucky,' 'Abseoda,' 'Glover,' 'Bernath,' 'Davis,' 'Fox,' and others. Hybrids of the shagbark hickory and the pecan make excellent, thrifty shade-trees but are shy bearers. Varieties available are 'Burlington,' 'McCallister' and others.

The native **American chestnut** has practically disappeared from the United States where it once made up large forests of trees valuable for timber and nuts. The trees were killed by the chestnut blight and much effort has been spent to find another chestnut species, or to make hybrids that would have resistanee to this disease. The most promising of these is the Chinese chestnut (*Castanea mollissima*). This is a medium-sized, round-headed tree bearing large nuts that closely resemble the American chestnut in flavor. The trees, though not immune to blight, are sufficiently resistant to it to be grown successfully in the blight area. Chinese chestnuts thrive best in light, friable soils that are well drained and somewhat acid. Planting two or more trees, either seedlings or different varieties together to provide eross-pollination is essential. The varieties 'Nanking,' 'Meiling,' and 'Kuling' have been named and propagated and are being grown in orchards in the South. 'Abundanee' is another good variety. Experienee in th North, however, has been that grafte trees often fail at the graft union. Fc home planting selected seedlings ar recommended.

Filberts or **hazelnuts** are grown con mercially in Oregon. The varieties use there, however, have not been satisfactor in the East. More promising are the hy brids between the European and th American hazel (*Corylus americana*). Sc lections from this group that are worth of trial are 'Bixby,' 'Buchanan,' 'Potc mac,' and 'Reed.' At least two varietie should be planted together for eross-poll nation. The plants make a tree or a bus about 15 feet high. If trained as a tre keeping the suckers pruned away fro the base of the trunk is necessary. Th Turkish tree hazel (*C. colurna*) is an ir teresting and unusual tree of mediu size for the dooryard.

Culture

Nut trees thrive in deep, friable so that would be rated as good agricultura land. Good drainage is essential an sandy or gravelly loams are better tha light clay. In planting an importan consideration is to tamp the soil firml around the roots. After planting libera watering is necessary and for the firs year or two water must be supplied i the soil gets dry. Grass and weeds shoul

Chinese chestnut with burs

be kept away from the trees by cultivation until they become established, then a mulch of straw or other litter is advisable. Growing nut trees respond to nitrogen fertilizer applied in the early spring.

Harvesting

Nuts of all kinds should be harvested as soon as they are ripe and the husks removed promptly. Shaking or jarring the trees and branches may be necessary. Nuts left on the ground for even a short time may become infested with molds or are carried away by rodents. After husking, walnuts are improved in appearance and quality by washing with water. All nuts except chestnuts should be spread out in thin layers in a well ventilated place to dry. When the kernels are so dry that they break with a "snap" between the fingers they are dry enough to be placed in bags or baskets and stored in a cool, dry place. Chestnuts, however, should be dried very little, then placed in polyethylene sacks in quantities of a few quarts or less and stored at 32°F. Fair success is had storing in the home refrigerator at 45°F. though the nuts will not keep as long at this temperature. The bags should have a few small holes made in them for ventilation.

This is a very brief and incomplete story of nut growing for the home gardener. Additional information may be secured from the secretary of the Northern Nut Growers Association, Spencer B. Chase, 2338 Park View Ave., Knoxville, Tenn. Agricultural Experiment Stations can often supply information on suitable varieties for their states. Cornell University Extension Bulletin 701 is very useful for the northern states.

Hazel nuts have leafy husks

McFarland photos

THE ORIENTAL PERSIMMON IN MARYLAND, VIRGINIA AND PENNSYLVANIA

Eugene Griffith and W. H. Preston, Jr.

THE Oriental persimmon (*Diospyros kaki* L. f.) is usually thought to be adapted to only the southern part of the United States, but actually it has been grown successfully in Maryland, northern Virginia, and southern Pensylvania. Some trees are known to be at least 30 years old and have withstood winter temperatures as low as −20°F. These trees bear fruits annually and are in excellent condition.

In these states the Oriental persimmon typically develops into a small, round-topped, deciduous tree 15 to 25 feet high. The lustrous dark-green leaves are slightly larger (3 to 7 inches long) than those of the American persimmon (*D. virginiana* L.), but are of the same general shape. In late fall the leaves of many varieties turn to rich yellow, orange, an red hues. The fruits also turn yello orange, or red, adding beauty to the tre with or without foliage. Thus the si and shape of the trees and the beauty the foliage and fruits make the Orient persimmon an outstanding ornament for landscaping and home gardening.

Hardy Varieties

Many varieties are cultivated in th Far East, where the fruit is very popu lar, and therefore most of the varieti imported into the United States have Or ental names. Varieties known to hav survived 30 or more winters in the Mary land, Virginia, and Pennsylvania area include 'Great Wall,' 'Peiping,' 'Pen 'Sheng,' 'Shaumopan,' 'Benigaki,' 'Oka

me,' 'Tsurushigaki,' 'Yokono,' 'Delicious,' and 'Manerh'; perhaps many other varieties are as hardy.

The Fruits

Fruits vary from plum-shaped to tomato- and heart-shaped and may be lobed, square, capped, or constricted, with many combinations and gradations. Size varies from small 1-ounce fruits less than 3 inches in circumference to enormous fruits weighing as much as ¾ pound and measuring 15 inches in circumference.

The flesh of ripe fruits may be yellow, orange, or brown, and may have a few to many dark-brown flecks. Fruits of some varieties are ripe and edible while still firm, whereas those of others must be soft; some may be slightly stringy. Flavor and sweetness vary considerably with variety.

The flavor of persimmon fruits cannot be easily discussed without mentioning astringency or "puckery" effect. Trees of certain varieties produce fruits of excellent flavor but are considered undesirable because of the astringency. However, astringency is easily removed from Oriental persimmon fruits merely by storing the fruits (firm but fairly well colored) with ripe or near-ripe apples in a closed container for 2 to 4 days at room temperature. This short period of storage is sufficient to remove all traces of astringency. Handling a few fruits at a time is even simpler, since they can be put in a plastic bag with an apple for the storage period. Loss of astringency is brought about by the ethylene produced in small amounts by the apples. Fumes of ethyl alcohol or carbon dioxide also remove astringency, as age-old practices by the Chinese and Japanese have demonstrated. They often stored fruits in empty sake barrels in which the fumes of alcohol still remaining inside the barrel accomplished the task. They also used carbon dioxide by burning dung in deep pits and passing the smoke through flues to covered pits where the fruits were stored.

Persimmon trees are considered dioecious; that is, male and female blossoms generally are borne on separate trees, but sometimes a male tree may bear several female flowers and a female tree several male ones. Some varieties show a tendency towards parthenocarpy or seedless fruit. In some instances fruit apparently is produced either with or without fertilization. In the latter case the fruit is seedless.

Ripening dates of the Oriental persimmon fruits depend largely on variety, and in Maryland, Virginia, and Pennsylvania, ripening may begin in late September and extend through November. However, the season for fresh fruits can be easily extended throughout the winter by storing well-colored, firm, non-bruised fruits at a low temperature (33-40°F.).

The fruits, while delicious for eating out-of-hand, can also be used for fruit salads, ice cream, sherbet, custard, cake, pudding, and pie. The fruits may be frozen whole, or pulped and then frozen for later use. Tannins present in the pulp cause some discoloration when the fruits are used with iron utensils. Such utensils should not be used.

Little Care Needed

No important disease or insect damage has been noted on the Oriental persimmon trees or fruits in Maryland, Virginia, and

Author courtesy

Typical habit of Oriental persimmon growing in open sun

Pennsylvania. In full sun, the trees are well-shaped and require little or no pruning. The many trees observed have grown for years without applications of fertilizer, but the foliage looks dark green and healthy. Thus the need for spraying, pruning and fertilization is at a minimum; nevertheless, the trees probably would respond to good cultural practices. They develop new leaves in late April and produce their inconspicuous cream-colored flowers in June. Late flowering reduces the possibility of frost damage and resultant loss of fruit crop.

The trees observed rarely developed a spread of more than 15 feet, and did not grow more than 20 feet high when grown in full sun. In competition with taller trees they grow as tall as 40 feet. Many Oriental varieties have been grafted on wild American persimmon understocks, and unions of scion to stock are usually good. However, some difficulty may be encountered in making successful grafts on some native trees.

The hardiness, usefulness, and beauty of the Oriental persimmon are attributes that recommend the tree to the landscaper, home gardener, and orchardist. Once its ease of cultivation and readily solved astringency problem are better understood by Americans, one may expect the Oriental persimmon to become a popular tree throughout most of the United States.

Graft union of *Diospyros kaki* var. 'Great Wall' on *D. virginiana* understock at 3½ feet above soil line

Photos author courtesy

Representative fruits of *Diospyros kaki* varieties

UNUSUAL FRUITS NOT COMMONLY GROWN

George L. Slate

THERE are many edible fruits of little or no commercial value which can be grown in the temperate zone, that add interest and variety to the home fruit garden. Some are useful for eating out of hand while others are chiefly useful in the kitchen. Several withstand the severe winters and hot dry summers of the Great Plains, and the early settlers made good use of them as there were few other fruits available.

These minor fruits are interesting novelties and they are often little troubled by insects and diseases. Some are not improved much from their wild state, but a few have been improved by breeding and interested persons have located and propagated superior wild types.

The native or **common persimmon** (*Diospyros virginiana*) is an attractive tree that grows to 50 feet in height in the open, where it makes a narrow, round-topped tree with dark green lustrous leaves. The fruit varies considerably in size, color, flavor, and time of ripening. The largest are about 2 inches in diameter and the color is usually yellow or orange, often with a reddish cheek. Inferior types and fruits not fully ripe are very astringent, but in the better varieties the astringency disappears when the fruit is ripe. Only the earliest varieties will ripen as far north as Geneva, New York, but several good ones usually mature before severe weather arrives. 'Garrettson,' the best variety tested by the writer, ripens in mid-October and remains in edible condition until Thanksgiving. Freezing will ruin immature fruits, but when fully ripe the fruit is not spoiled by the temperatures that usually occur before Thanksgiving. 'Early Golden' and 'Killen' are also good sorts.

The persimmon is dioecious, that is, the male and female flowers are borne on separate plants. Hence a male tree must be in every planting to provide pollen for the female flowers. If one is clever with the grafting knife part of a male tree may be grafted to a female tree of a good variety, as only a branch or two is needed to provide pollen.

The **papaw** (*Asimina triloba*) is the only member of the Annonaceae, the custard apple family, which is hardy in the northern United States. It ranges from Lake Ontario to the Gulf of Mexico, usually being found on rich bottom lands. The tree grows from 10 to 15 feet in height and has large glossy leaves, 6 to 8

Fruits of pawpaw (*Asimina triloba*)

Creamy white blossoms and dark purple fruit of elderberry (*Sambucus canadensis*) ar borne in large flat clusters

inches long, which give the plant a tropical appearance unlike other small trees that grow in the northern states.

The fruits are 4 to 6 inches long, yellowish in color, with a sweet, richly flavored, highly perfumed edible pulp in which are embedded numerous brown seeds as large as lima beans. Only the earliest ripen in Geneva before frost. No named varieties are available from nurseries so one will have to locate seeds of superior early ripening types and grow his own. The trees transplant with difficulty, hence only small seedlings should be planted.

The genus *Prunus*, which includes peaches, plums, and cherries, has several less important species that are occasionally cultivated for their edible fruits.

The **Western sand cherry** (*Prunus besseyi*), a native of the Great Plains region, is a low shrub, 3 to 4 feet high, that is attractive in foliage, and is a mass of white when in bloom. It bears early and heavily. In the humid East the fruit and twigs are sometimes injured by brown rot. Great Plains horticulturists have improved the sand cherry by breeding so that the best named varieties are much superior in fruit characters to the bush cherries often sold by nurseries, which produce harsh, astringent fruits of little use except for jelly. The best varie ties are 'Black Beauty,' 'Brooks,' an 'Sioux,' and even these are far inferio to the sweet and sour cherry varieties However, sand cherries may be grow where their better relatives are not winte hardy and the fruits add interest an variety to the home fruit garden.

The **beach plum** (*Prunus maritima*) o the sand dunes of the Atlantic Coast i prized as a jelly fruit, but is not of muc use for eating fresh. Superior wil types have been discovered and named but are not generally available. Beac plums are a good ornamental for sand seashore gardens as they are tolerant o salt air and attractive in bloom, as wel as producing usable fruit. The plant grow from 4 to 10 feet in height.

Nanking cherry (*Prunus tomentosa*) a dwarf cherry from northern China grows 6 to 8 feet tall and bears a mas of white flowers very early in the spring followed by a crop of bright red cherrie with a pleasant and refreshing flavor It is well worth growing as an orna mental.

Korean cherry (*Prunus japonica*) grows to 4 feet and bears heavy crops o cherry-like fruits that are about the size of sour cherries and much firmer. Many of the seedlings produce sour and astrin

Showy flowers and large fruit of common quince (*Cydonia oblonga*)

gent fruits, but some are of good quality and make good pies.

The **high-bush cranberry** (*Viburnum trilobum*) is a strong-growing native shrub bearing large clusters of red fruits, about the size of cranberries, that may be used for jelly. The plants are very hardy and grow up to 12 feet in height. Selected varieties have been named, but are not available from nurseries.

Juneberry (*Amelanchier alnifolia*), a Great Plains native, was popular with the early settlers and the Indians. The plants grow about 3 feet tall and bear heavy crops of berries that ripen near the end of the strawberry season and bear a superficial resemblance to blueberries. They are useful for pies but lemon juice should be added as the berries are mild-flavored. Birds are very fond of them and will take the crop unless the bushes are covered.

American elder (*Sambucus canadensis*) is a useful pie and jelly fruit, and is even processed commercially. The variety 'Adams' is somewhat more productive than the general run of wild bushes. Some breeding work is being done to improve elderberry for commercial planting. More than one clone should be planted to provide cross pollination unless wild plants are nearby.

The **quince** (*Cydonia oblonga*) produces large golden fruits that are not edible raw, but make a delicious jelly and conserve. The trees grow 10 to 12 feet tall and are attractive in bloom. They are susceptible to fire blight and should not be grown too vigorously. Spraying for the oriental fruit moth is necessary.

Actinidia (*A. arguta*) is a handsome vine producing greenish yellow fruits, about an inch long, that are pleasant to eat and make an excellent conserve.

Mulberries (*Morus* spp.) have long been a dooryard tree. The fruit ripens over a period of several weeks and is beloved by the birds. Good varieties true to name are hard to get, but 'New American' and 'Downing' are old varieties with a good reputation. They should not be planted near the house or a side-walk as the juicy fruits are messy and stain clothing.

The **buffalo-berry** (*Shepherdia argentia*), another Great Plains native, produces small, red, acid, but pleasantly flavored fruits on thorny shrubs that grow from 5 to 20 feet in height. The berries make good jelly and the silvery foliage makes the plant an attractive ornamental.

PROGRESS IN PEST CONTROL

E. H. Smith

THE past two decades have witnessed remarkable progress in pest control. Prior to this time, little encouragement could be offered to the amateur who wished to grow fruit in the home orchard. Pesticides then available were of limited effectiveness and some, such as lead arsenate, often caused injury to trees.

A new era began in 1942 with the introduction of DDT. Since then, literally hundreds of new pesticides have come from the assembly lines of organic chemists here and abroad. These potent chemicals have revolutionized pest control. This is not to say that they provide the final answer. Indeed, they do not. Their use sometimes upsets the balance of nature, resulting in exchanging one pest for another. And too, chemical control provides no permanent solution to the pest problem. The professional in pest control is well aware of these limitations but, until research opens some new avenues, he is forced to continue with methods which, despite their drawbacks, currently provide the means for producing higher yields with less loss from pests than ever before.

Selective Killing Needed

The problem in pest control is to kill pests without harming other organisms living in close association with them. To achieve this selective killing is a large order because the vital processes of pests, plants and mammals, including man, all have some features in common. Before considering the decimation of the pests, let us first consider the safeguarding of some other living organisms in the biological complex of the home orchard.

Author courtesy

With effective pesticides, small power sprayers and dwarf fruit trees, the outlook for pest control in the home orchard is greatly improved

These include the trees on which the fruit is produced, the orchardist who tends them and, finally, the consumer.

Protection for the Trees

Spraying trees with chemicals is at best an unnatural practice likely to interfere with the normal proeesses of the plant. The goal with respect to the tree is to keep this interference to a minimum. To do this, a few principles should be borne in mind.

Don't overspray. The philosophy that "if a little is good, a lot is better" is unsound here. Spray till leaves and fruit are wet. Don't worry if only a light residue is visible after the spray dries.

If the spray dries before a summer shower, chances are that little effectiveness is lost. If a washing rain oceurs (½ inch or more), better spray again a few days later. Spray injury is most likely under poor drying conditions.

Extremes of temperature increase the likelihood of spray injury. Low temperature at the time of spraying may cause fruit russet while high temperature causes scald.

Keep the number of pesticides in the spray mixture to a minimum. By using materials with a wide range of effectiveness, all-round protection can be had with several materials.

Protection for the Grower

While pesticides available to the home orchardists are reasonably safe, their misuse ean render them unsafe. Your best proteetion is the label. It provides answers to three essential questions:

1. What is the chemical?
2. Against what pests is it effective?
3. How can it be safely used?

The manufacturer has been required by law to meet exaeting requirements before making claims on the label for his product. While there is no law to require the user to read the label, common sense dictates it. The two chief safeguards in the use of pesticides are:

1. Follow directions on the label.
2. Store pesticides in a safe plaee—out of reach of children and pets.

Protection for the Consumer

Much publicity has recently been given to the hazard of chemicals in food. The chemical age is relatively new and new practices have traditionally come under criticism before gaining public aeceptance. Federal agencies are charged with the responsibility of safeguarding public health. To do this, residue tolerances applicable to produce offered for sale are established, based on extensive tests with laboratory animals. It is difficult for the layman to determine the adequacy of these safeguards but we believe that he will find the program in responsible hands.

Several natural faetors operate to reduce spray residue present at harvest: (1) The chemical is greatly diluted with water before spraying. (2) Limited quantities of the chemicals ean be made to adhere to the fruit and foliage in a single spray. (3) The aetion of sunlight, rain, and wind immediately begins to break down the chemicals.

It seems apparent that the ehemical age is here to stay. We can learn to regulate the use of chemieals to man's advantage.

We often hear laments about the eountless pests which now attaek our crops. Several factors, real and imaginary, aecount for the impression that the situation is worse than formerly. First is the human tendency to imagine the "good ole days" as better than they were. With lower standards, produce then acceptable to the market or to the home orchardist could not meet current standards. Seeond, it is true that we now have more pests to contend with. There are the native pests to which we fell heir when the early settlers introduced eultivated fruits to this country. In addition, we have the introduced pests which inevitably gained access through international eommerce. To add to our troubles, some minor pests have become major pests through shifts in the balance of nature. Another faetor which may eontribute to the problem of the home orchardist is the presence of adjoining unsprayed plantings which

provide sanctuaries for pests. Despite all of this, pest-free fruit can and is being produced with reasonable effort.

To the uninformed, an air of mystery surrounds the activity of insects and other pests. This is probably a carry-over from the early days when pests were regarded with superstition and ignorance. The development of pests proceeds with the same regularity and in response to some of the same life forces as does that of the host plants which are more readily observed. For instance, the spring activity of both the apple tree and the plum curculio is regulated by temperature. Host and pest are so synchronized that year in and year out the curculio usually emerges from hibernation and arrives in the tree as it comes into bloom. With a little study the home orchardist who has acquired a "green thumb" can also develop practical know-how in pest control. Vigilance in detecting pests can become a fascinating feature of home gardening.

Success in control of insect and disease pests depends of three factors: (1) Use of effective pesticides, (2) proper timing of treatments, and (3) thorough coverage of fruit and foliage. These principles apply to both commercial and home orchards.

Effective Pesticides

A general purpose spray meeting the needs of the home orchardist has long been sought. No single pesticide effective against all of the pests has been found and many of the more effective pesticides employed commercially are considered too dangerous for use about the home.

In recent years a number of safe and effective materials have been developed. Efforts were then made to combine these so as to provide all-round effectiveness. While this would seem to be a simple matter, it involved complex problems of compatibility. That is, the chemicals in combination often either lost their effectiveness when stored or produced injury when applied to the foliage. Once this problem was overcome, the one-package general purpose mixture became a reality.

While the mixture is more convenient to use, the ingredients may be purchased separately and added to the water separately. The composition of a mixture which has proved effective in tests throughout the Northeast and quantities required separately or in combination are given in the table below.

Malathion and methoxychlor are effective against insects, while captan is included for control of plant diseases. Mixtures of this general type are being marketed under various trade names. Those having essentially this composition should prove satisfactory. Their identity can be verified by checking the label on the package.

Timing of Treatments

The development of pests is closely correlated with the development of the tree, both being regulated by temperature. For this reason, sprays are generally timed according to tree development which can be more readily observed than the pests themselves. Seasonal variations tend to equalize several weeks after bloom so that timing is not so critical then. Sprays applied after the fruit is formed are termed "cover sprays" and are generally applied at intervals of approximately 10 days.

The most important period of pest ac-

General Purpose Spray Mixture

	Per cent of mixture	Quantities required to make 1 gallon	25 gallons
Malathion (25% wettable powder)	30	2 tbsp.	½ pound
Methoxychlor (50% wettable powder)	35	3 tbsp.	¾ pound
Captan (50% wettable powder)	35	3 tbsp.	¾ pound
Complete mixture	100	8 tbsp.	2 pounds

Timing schedule of "general purpose" sprays for control of fruit pests

Stage of tree development	Apple	Peach	Plum	Cherry	Pear
Dormant		*			
Green-tip	x	(note below)			
Pre-bloom	x	x	x	x	x
Bloom		Do Not Spray During Bloom			
Petal fall	x	x	x	x	x
1st cover	x	x	x	x	x
2nd cover	x	x	x	x	x
3rd cover	x			x	
4th cover	x	x		x	
5th cover	x				
6th cover	x	x			x
7th cover	x				x

*General purpose mixture ineffective. Spray with ferbam, 2 tablespoons per gallon, or ½ lb. per 25 gallons.

Definition of terms:

Dormant—Before buds show any green

Green-tip—When buds have broken enough to show green tissue

Pre-bloom—When blossom buds begin to show color

Bloom—When blossoms are open

Petal fall—When the last petals have fallen from the blossoms

1st cover—10 days after petal fall

2nd through 7th cover—At 10- to 14-day intervals

Add Kelthane if mite becomes a problem.

tivity is during the several weeks following bloom. (Caution: sprays must not be applied during bloom because of the risk of killing bees.) The effect of a single spray lasts for approximately ten days. Usually several species of pests are susceptible to treatment at the same time so that a single spray may provide protection against a number of pests. Sprays should not be applied later than 1 to 2 weeks before harvest. The safe interval for a particular formulation will appear on the label.

Thorough Coverage Essential

As would be expected, effective control can be obtained only when the fruit and foliage are thoroughly covered. This poses a difficult problem to the home orchardist especially with large or poorly pruned trees. Manufacturers of commercial spray machinery now carry small capacity power sprayers suitable for the home orchard. The chief drawback to such equipment is its high cost considering returns on the investment.

The problem of coverage is greatly simplified by the use of dwarf trees which remain within reach of a knapsack sprayer.

Diseases and Pests of Specific Fruits

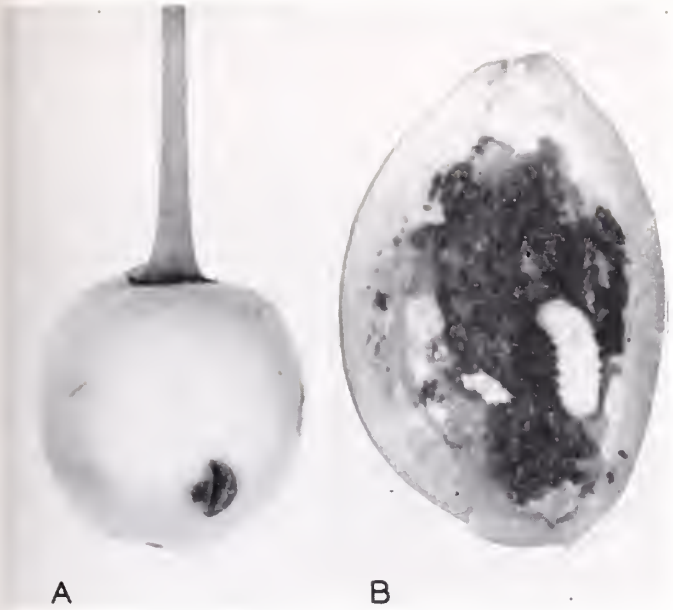
Each of the fruits grown in the home orchard presents a different problem with respect to pest control. This fact should be considered in selecting the fruits best suited to home plantings.

The **apple** has perhaps the largest number of pests of all fruits. The codling moth and apple scab are the major problems. Scab accounts for loss of foliage and disfigured fruit (p. 42). Infection occurs during periods of rainfall from the time green tissue appears in the spring until late June. The amateur would do well to select varieties least susceptible to this disease. The codling moth (p. 42) is the chief cause of wormy apples. Other common pests of the apple

Apple scab on fruit and leaves

Codling moth, showing adult and frass made by worm

Newly hatched aphids on apple bud in green-tip stage



(A) Plum curculio egg-laying scar on cherry
(B) Curculio worm **in plum**

Photos author courtesy

include plum curculio, aphids (p. 42), apple maggot, bud moth, and leaf rollers.

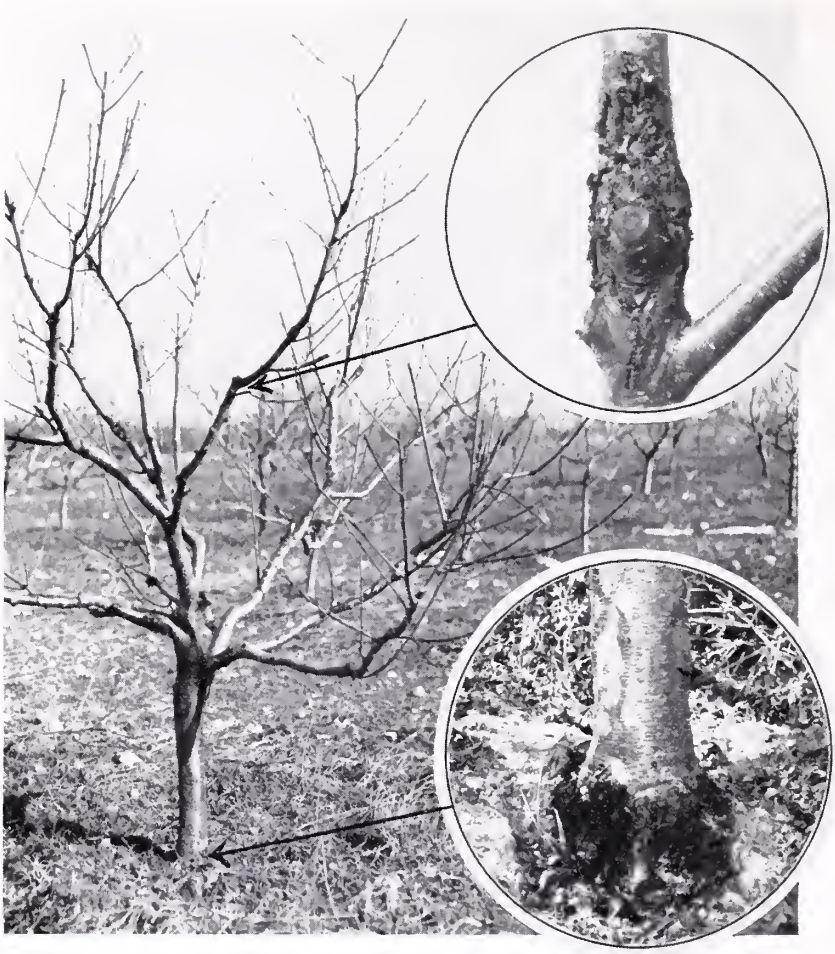
Pear. The chief pest of pears is the pear psylla which covers the fruit and foliage with sticky honeydew, reduces the vigor of the tree, and stunts the fruit. The codling moth attacks pears as well as apples but to a lesser extent. Because of its relatively few pests, the pear is well suited to home plantings.

Stone fruits—peaches, plums, cherries. All of the stone fruits have some of the same pests, notably plum curculio and brown rot. The curculio may be distinguished by its crescent-shaped egg laying scar (see above). The fruits of peaches and plums infested by the plum curculio drop from the tree before maturing, while infested cherries remain on the tree and may be harvested.

In addition, peaches are attacked by the Oriental fruit moth which kills the tender terminal shoots and later produces wormy peaches. Peaches must also be protected from borers by spraying the trunk and branches. Two species of borers attack the trees (p. 44). The larger one confines its attack to the tree trunk at soil level while the smaller one attacks scaffold branches as well as the trunk. The peach tree borer (at soil level) is a particularly troublesome pest, often killing trees outright. The borers are among the easiest pests to control, yet, because they are frequently overlooked, account for perhaps the most serious injury. One disease of peach, leaf curl (p. 45), does not respond to the general purpose spray suggested on page 41 and requires special dormant treatment as shown in the special note at the bottom of the table.

Plums and prunes have relatively few pests besides curculio and brown rot. In severe infestations, the entire crop may drop before harvest, due to injury by the plum curculio. Fruits drop from the tree from other causes such as poor tree vigor, poor pollination, and excessive crop. The presence of worms in the dropped fruits is sure evidence that the curculio is responsible.

Wormy cherries are produced by cherry fruit fly (p. 45) as well as plum curculio. The foliage is attacked by the cherry leaf spot disease which causes leaves to turn yellow and drop prematurely. Sour cherries are more severely attacked by both fruit flies and leaf spot



Peach trees are attacked by two species of borers. Peach tree borer injury at soil level and lesser injury on branches

than are sweet cherries.

In some cases, mites have become a problem even where the recommended combination of pesticides is used, probably due to the development of resistance. When mites are a problem, Kelthane should be used following manufacturer's directions. The presence of mites can be detected by carefully inspecting the undersides of the leaves with a magnifying glass. Severe injury, which reduces the vigor of the trees, is apparent from the bronzed color of the foliage.

The timing of sprays required for control of pests on various fruits is given in the table. This program eliminates dormant sprays with the exception of one treatment for peach leaf curl. Dormant sprays for the home orchardists have been better in theory than in practice. While the idea of striking the immobile pests before they become active is sound, several considerations hinder its accomplishment. Weather is often unfavorable. Motor driven spray equipment is subject to later damage by freezing unless properly drained. Another disadvantage is the limited choice of pesticides. The old standby, dinitro compound, is a dye and spray drift to adjoining clothes lines or

Peach leaf curl disease

buildings poses a problem. Lime sulfur is caustic in high concentrations. Petroleum oil emulsions are convenient to use, their chief disadvantage being limited range of effectiveness against the pest complex. The trend toward control with minimum dormant spraying, while still on trial, has met with encouraging results.

In conclusion, it can be said that the outlook for pest control in the home orchard is greatly improved. An effective general purpose mixture is a reality. Small power sprayers have been designed to meet home growers' needs. Dwarf trees are available which simplify spraying and harvest. These developments go a long way in making it practical to carry out the three essentials of pest control. If control measures fail, each of these factors should be considered carefully to account for the results obtained. In this way, the element of mystery so frequently associated with the occurrence of insects and diseases can be removed.

Photos author courtesy

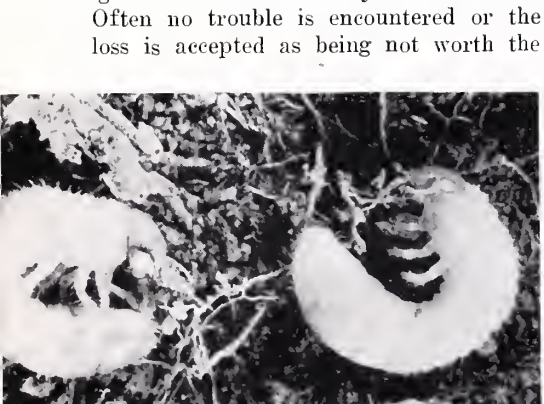
Cherry fruit fly which together with the plum curculio is responsible for wormy cherries

CONTROLLING SMALL FRUIT INSECTS AND DISEASES

George L. Slate

SMALL fruits in general are troubled less by diseases and insects than are tree fruits. Many home gardeners and even commercial growers often do not spray their berry plantings. Nevertheless there are occasions when spraying is necessary. It may save a crop which might be a complete loss if unsprayed; and it may often reduce losses which are unrecognized by the grower. It is always good insurance to know what troubles may occur an dto watch for their apearance. If they are frequent, it will pay to spray the crop according to the spray programs available from most Agricultural Extension Services at State Colleges of Agriculture, or from county agencies.

Strawberries have their share of insects and diseases but most home gardeners ignore them unless they have trouble. Often no trouble is encountered or the loss is accepted as being not worth the bother of taking control measures each year when the insect or disease may not be present, or is causing very little injury.



Buhle

White grubs

Strawberry Insects

Tarnished plant bug feeds on the young fruits before they expand, causing hard seedy ends to develop. Formerly these berries, known as nubbins, were thought to be the result of poor pollination or frost injury to the blossoms. The plant bug is easily controlled by spraying the plants with DDT at the rate of 2 pounds of the wettable powder in 100 gallons of water, making the application just before the first flowers open. Weedy, brushy areas immediately adjoining the strawberry bed should also be sprayed.

Cyclamen mite. This very tiny mite feeds on the young leaves before they unfold, causing severe stunting. If serious, the plant is worthless. Northern gardeners should discard their plantings and replace them with plants from Maryland as the insect ordinarily does not live through the summer in that latitude. It is primarily a pest of strawberries in the northern states and Canada. Thiodan, 3 tablespoons in 5 gallons of water, applied as a very heavy crown drench will control cyclamen mite. It should be used only on non-fruiting beds the year before fruiting or after harvest on fruiting beds. Use it with great care.

White grubs may infest strawberries planted after a grass sod. They feed on the roots. If grubs are seen when the soil is being prepared for planting, apply chlordane according to instructions on the package.

Strawberry Diseases

Leaf troubles. Three diseases cause spotting or discoloration of the leaves. These are leaf spot, leaf scorch and leaf blight. They are rarely troublesome on present day varieties, but are often present in strawberry beds where air circulation is poor, or in a wet season. Spraying is not likely to be worth while unless the injury is severe every year, in which case a more resistant variety should be sought.

Red stele is a fungus disease of the roots, usually serious only in poorly drained soils or in other soils in very wet springs. The center of the root is reddish brown and the roots decay. The only control is the use of resistant varieties. 'Sparkle,' 'Fairland,' 'Redglow,' 'Sureerop' and 'Vermilion' are resistant.

Verticillium wilt is another soil fungus, usually serious only when strawberries are grown after tomatoes. Keep strawberries off ground that has grown tomatoes. These varieties are somewhat resistant to wilt: 'Vermilion,' 'Catskill,' 'Cavalier' and 'Siletz.' Moderately resistant varieties are 'Surecrop,' 'Tennessee Beauty,' 'Robinson' and 'Grenadier.'

Viruses cause the plants to decline in vigor and become less productive. There are no visible symptoms. Plants from nurseries practicing control measures are mostly quite virus-free and should be used in preference to plants that are several years removed from such a program.

Fruit rot. This may be serious in wet years, especially in beds that are too thick. If wide, dense beds are fertilized with a nitrogenous fertilizer in the spring of the bearing year and the season is wet, most of the crop will rot. Keep fertilizers off the bed in the spring of the fruiting year, keep the rows narrow (not over a foot wide) or, preferably, in hills to reduce rotting. Captan sprays used according to instructions on the package may reduce rot somewhat.

Other Troubles

Sterile flowers. Many flowers may fail to develop into berries. Usually this is caused by having the plants too thick and too vigorous.

Winter injury is usually found in unmulched beds or in beds where the mulch was applied after the plants experienced severe cold. The plants wilt and die about the time the berries begin to ripen. If examined, the interior of the crown is found to be brown. Mulching the plants with at least 2 inches of straw before the temperature drops below 20°F. should give adequate protection against low winter temperatures.

Slugs eat holes in the berries, especially in wet weather. Use a metaldehyde bait according to directions.

Birds are a serious problem in garden plantings. Cover the plants with cheese cloth or other netting.

Raspberries

Raspberries are often grown without much attention being paid to the control of insects and diseases, but most garden plantings need some control measures if they are to thrive.

Wild raspberries and run-out garden and commercial plantings nearby may harbor virus diseases, orange rust and various insect pests of raspberries. They should be avoided or removed if possible or their troubles may spread to new plantings nearby.

Roche

Slugs can be controlled with metaldehyde baits

Raspberry Insects

Raspberry fruitworm causes wormy berries and destroys blossom buds. If present, it may be controlled by spraying the plants with DDT, 2 pounds in 100 gallons of water. The first application is made when blossom buds first appear, the second just before the first flowers open. This spray is also helpful in controlling stink bugs and various borers.

Borers. Several kinds of these tunnel in canes. Infested canes should be cut out and burned. Wilted tips of new shoots are caused by egglaying of insects which later become borers. The wilted tips should be removed and destroyed.

Tree crickets lay a row of eggs in the upper portion of the cane, weakening it so that the cane breaks at that point. Remove and burn the portion of the cane containing the eggs when pruning the plants.

Raspberry Diseases

Virus diseases. There are several virus diseases of raspberries, varying in their symptoms and their effects on the plant. Plants of some varieties rarely become infected; others may become infected, but are so tolerant of the virus that they will continue to produce fairly profitable crops. Others, especially the black raspberries, may be killed by the virus.

The best method of handling the virus situation is to plant only virus-free plants away from known sources of the virus. Wild raspberries usually harbor viruses which may spread to nearby cultivated raspberries. Run-out cultivated raspberries are often virus-infected and a menace to newly-planted raspberries nearby. When possible these should be destroyed or avoided.

One should learn the symptoms of *mosaic* and remove infected plants as soon as discovered. If this is done promptly and there are no sources of infection nearby, the planting may be kept in good health for many years.

Some red raspberry varieties, 'September,' 'Milton' and 'Indian Summer,' usually escape mosaic and it is not necessary to pay special attention to keeping them away from mosaic-infected raspberries. All of the black and purple raspberries are seriously injured by viruses and every precaution must be taken to protect them.

Verticillium wilt. This soil-borne fungus attacks the roots of black and purple raspberries causing the canes to develop a bluish color and soon to die. It is much more serious in raspberries that are planted on land that has recently grown tomatoes, peppers, eggplants and potatoes; hence, raspberries should not follow these crops except after an interval of several years. Wilt-infected plants should be removed from the planting when detected.

Spur blight causes large purplish areas surrounding the buds of red raspberry varieties which may be killed. Narrow rows, keeping the weeds down, and good air circulation will reduce losses from this disease.

Anthracnose causes spotting of the canes of black and purple raspberries. Good air circulation may reduce damage, but prolonged wet periods favor the fungus and considerable damage may result. If there are too many lesions on the canes they may be winter-killed the following winter. Control is by spraying the canes in the spring with lime-sulfur, 4 gallons in 100 gallons of water when the new leaves are about ½-inch in diameter.

Orange rust. This systemic disease is caused by a fungus which stunts the plants so that they are worthless. Yellow pustules appear on the undersides of the leaves. Infected plants should be destroyed promptly in the planting and in wild and cultivated brambles nearby.

Other Troubles of Raspberries

Crumbly berries. The cause of this trouble is not known, but affected plants do not recover so they may as well be replaced with a new stock.

Winter injury. Raspberry canes are often winter-killed. They may be killed to the ground, but often they are only weakened and may die any time from the start of growth in the spring until the fruit is ripening. Hot, dry weather at

ripening time and the demands of the plant for water for the ripening berries and foliage are more than the winter-injured water-conducting tissues can supply. The fruiting canes dry up before the crop is mature. New shoots are uninjured and grow strongly.

Too vigorous growth, often stimulated by too much manure, heavy nitrogen applications, late cultivation, heavy fall rains and warm weather late in the fall are causes of winter-killing. Mild weather in mid- or late winter followed by sudden severe cold may cause winter-killing.

Over-vigorous growth in late fall should be avoided. Cultivation should be discontinued about August 1 and a cover crop of rye, oats or buckwheat seeded between the rows. Annual weeds will function as a cover crop. It may be necessary to try several varieties to find one that is winter-hardy. Winter-killing is usually much more severe south of New York than in the northern tier of states.

Blackberry Insects

Tarnished plant bug feeds on the blossoms so that they fail to develop into normal berries. Brushy fence-rows, woods and weedy areas favor this insect. It is easily controlled by spraying the plants just before they bloom, using DDT at the rate of 2 pounds of the 50 per cent wettable powder in 100 gallons of water.

Aphids distort and curl the tip leaves and should be controlled with an aphicide as soon as they appear.

Blackberry Diseases

Orange rust. This systemic disease of blackberries stunts the plant severely and is diagnosed by the orange pustules on the undersides of the leaves in early summer. Infected plants must be detected early and removed or the planting will soon be destroyed. Wild plants nearby are a source of infection and should be destroyed if infected with orange rust.

Sterile flowers. A sterile blackberry clone, which blossoms but produces no fruit, has been sold for many years under various blackberry names. It should be destroyed as it will not produce any berries.

Currant Insects

Aphids are nearly always present on unsprayed currant bushes. They distort the leaves and greatly reduce their efficiency. Some of the leaves may drop and the fruit does not ripen properly. Currant aphids are best controlled by spraying the bushes when dormant, or when the buds are just showing green, at which time the eggs are destroyed. Elgetol, Dinitrosol or Krenite may be used at the rate of 1½ quarts in 100 gallons of water.

If the dormant spray is not used, the aphids can be controlled by spraying them with nicotine sulfate at the rate of one pint in 100 gallons of water, plus 2 to 3 pounds of soap flakes. This spray is applied when the first leaves have a diameter of ½ to 1 inch.

Stem girdlers girdle the tips of new shoots which die and fall off. The wilting tips should be removed and destroyed as soon as noticed, making the cut about 2 inches below the girdle.

Currant borers burrow in the pith of the canes causing them to die. Infested canes should be removed and destroyed when discovered or at the spring pruning.

Imported currant worm occasionally defoliates currants, doing the job in a few days. Rotenone sprays should be used as soon as the worms are observed and before many leaves have been eaten.

Currant Diseases

Leafspots. These defoliate currants prematurely but are rarely controlled. However, they may be controlled with bordeaux mixture, zineb, or ferbam if necessary.

Grape Diseases

Grapes in home gardens are often troubled more by diseases and insects than in commercial vineyards. In the garden they are often grown on the sides of buildings, fences or overhead trellises and are difficult to prune or spray properly. The vines are sometimes partially shaded; air circulation is poor; and the vines may be too thick. These conditions favor fungus diseases and insects.

Satisfactory control of grape troubles starts with vines growing in a sunny situ-

Downy mildew on 'Niagara' grapes

ation with good air circulation and proper pruning. Under these conditions spraying is most effective.

Black rot is the most serious and widespread disease of grapes in the Eastern United States. The fruits begin rotting when half-grown and the berries soon become hard, shrivelled mummies. The leaves are often attacked by the fungus. Ferbam and captan are effective fungicides for black rot control. Thorough coverage and proper timing of the sprays are essential to good control.

Downy and powdery mildews are destructive to some varieties in certain areas. Bordeaux mixture will control these diseases but may injure the vines, hence fixed copper sprays are preferred.

Grape Insects

Grape leafhoppers suck the sap from the leaves, thereby reducing the efficiency of the foliage. The crop does not ripen properly and fruit color, sugar content and flavor are reduced in proportion to the amount of damage. The ability of the vine to withstand low winter temperatures may be reduced if leafhopper feeding is extensive. Vine vigor and cropping in future years is reduced. Since the injury is not striking in appearance it is often overlooked.

The leafhopper is readily controlled by spraying the vines with DDT either immediately before bloom or 10 to 14 days after bloom. The spray should be directed upward to hit the undersides of the leaves where the leafhoppers congregate.

The **grape berry moth** causes wormy grapes. It is not serious everywhere, but when wormy grapes are numerous control measures should be applied. DDT sprays applied according to local recommendations will control berry moth as well as the grape leafhopper and the Japanese beetle.

Bees, wasps and birds often feed on grapes. Honey bees apparently feed only on grapes that have cracked or have been damaged by wasps and birds. The simplest method of preventing damage is by covering the grape clusters with paper sacks as soon as the fruit begins to color. The No. 2 size sack is large enough for most varieties. Only white paper sacks should be used as the brown paper imparts a very unpleasant flavor to the fruit. The sack is pulled up over the cluster and fastened at the top with a stout pin. It is advisable to cut off the lower corner of the sack to permit rain water to drain away.

BIRD DAMAGE TO FRUIT CROPS

Roger D. Way

MANY techniques to prevent birds from destroying fruit crops have been tried but, thus far, the only practical measure to assure protection from birds, at least in the small home garden, is to cover the plants with a net.

Every year birds destroy large quantities of cherries, blueberries, and grapes. They also cause a great deal of damage to peaches, elderberries, strawberries, pears, raspberries, apples, currants, plums, and other fruit crops. Bird damage to sour cherry, one of the most important fruit crops in several northern states, results in tremendous economic losses. In 1960 in certain commercial sour cherry orchards in New York, 20 per cent or more of the fruit was destroyed. Reports of near 100 per cent destruction of fruit crops are not uncommon. Bird depredation of fruits amounts to millions of dollars annually. Birds have caused real agony to individual fruit farmers by destroying large quantities of valuable fruit or prize show specimens. Damage caused by birds on fruit crops often greatly exceeds the total combined damage incurred by insects, diseases, rodents, and inclement weather.

The extent of fruit damage due to birds varies from year to year. Because of different weather conditions, varying food supplies, and other factors, some not fully understood, damage may be ten times greater one year than another. During 1960 in one county alone in New York State, crop damage due to birds exceeded $175,000. Damage caused by pecking and puncturing of fruit skins is often greater than damage caused by the eating of fruits. Birds are sometimes highly selective in their eating habits. For example, extensive damage has occurred on one variety of pear and very little on another variety fruiting in the same orchard. Early ripening varieties of black sweet cherries are especially susceptible to bird damage.

Kinds of Birds Causing Damage

A large number of different kinds of birds are responsible for damage to ripening fruit crops. Among the most destructive are starlings, robins, and cedar waxwings. Serious fruit destruction has also been caused by crows, sparrows, and red-winged blackbirds. Blueberries have been found in the stomachs of 93 kinds of birds. In some fruit plantings starlings may be the most plentiful species, in other plantings, sparrows. In England, finches cause one of the most serious types of destruction to fruit crops by removing fruit buds from dormant trees during the winter and, consequently, the size of the crop the following summer is reduced.

Bird damage to fruit in small plantings is often more noticeable than that in large plantings. In fact, large fruit plantings usually suffer a smaller percentage loss due to birds than small plantings. In most large commercial cherry orchards, the grower seldom suffers a loss of more than half his crop, but every cherry is frequently removed before ripening from individual cherry trees in backyards.

Contrary to popular belief, birds are not particularly effective in controlling destructive insects. Surveys have shown that birds do frequently eat large quantities of caterpillars, but their effectiveness in significantly reducing the over-all population of destructive insect species has been demonstrated in only a few cases.

Methods of Control

Controlling birds for the purpose of preventing damage to fruit plantings is extremely difficult. Many techniques have been tried. Some of these new techniques

Grapes protected from birds by enclosing bunches in white paper bags

have sometimes met with a considerable degree of success. In large commercial plantings, some of the most successful, large-scale techniques are genuinely workable deterrents and are of tremendous economic benefit to the fruit grower. However, thus far, the only completely sure method of preventing bird destruction on fruits is to physically obstruct the birds from getting at the fruit. Cloth netting over an individual blueberry bush is a very practical solution for the home gardener. Twenty blueberry plants can be profitably covered with a cage of chicken wire. Half-inch-weave netting made of waterproof paper fabric is less expensive than cloth or wire netting. In New Zealand, commercial growers even find that growing five acres of sweet cherries under wire-mesh cages is an economical practice.

The placing of white paper bags over clusters of grapes or individual prize specimens or branches of fruit is also a very practical method in deterring birds on a small scale. Brown paper bags should not be used because they give the fruit a bad flavor, making it too strong.

Many other methods of controlling birds in fruit plantings have been tried. Most of these methods involve killing or frightening the birds. *Listing of certain*

McFarland

Strawberries protected from birds by wire netting over rows

drastic measures here does not necessarily mean that they are recommended for use and, in all cases, one must abide by state and local laws which govern the killing of birds or the making of noises.

Methods which depend on the mass killing of destructive birds are generally relatively ineffective. If crop damage is to be materially reduced by this method, a large proportion of a population must be destroyed. This is usually impractical, if not impossible, and is prohibitively expensive.

Despite the invention of new techniques to control birds, shooting starlings in large orchards is still very practical. Here, shooting does not materially reduce the size of the population but it is primarily a technique of frightening other starlings. A writer in England recently stated that it is the best method, most economical. Some large growers have kept two guns employed daily for several months. Birds, like men, are able to learn and although a noise maker may frighten birds many times, eventually they learn that there is no danger; they eventually return to destroy the crop. Shooting a starling periodically instills a permanent fear in the others.

Scarecrows with power-driven moving arms are useful but, periodically, they

must be the farmer in disguise or the birds will learn to be unafraid of them. In any case, scarecrows must not be constructed too early in the season; their effectiveness depends on birds being frightened at the critical stage when the fruit is ripening.

Noise makers of many types have been used with varying success. As early as 1614, Gervase Markham in England wrote, "You must have some boy or young fellow that must every morning from the dawning of the day till the Sunne be more than an houre high, and every evening from five of the clocke till nine, runne up and downe your ground, whooping, showting and making of a great noyse, or now and then shooting of some Harquebush, or other Peece: but by no meanes to use slings or throwing of stones, least by miscarriage of his hand hee either beate downe the fruit or bruise the trees." Even today, making noises in the orchard is still one of the most effective means of controlling birds. Some commercial sweet cherry growers find it profitable to drive their cars, blowing the horn, through the orchard several times daily just before harvest. A car without a muffler is also useful. Although flocks of birds generally fly away because of this noise, they also usually return quickly.

Exploding devices of several types have been used with considerable success. Gas-powered cannons, machines attached to acetylene tanks or generators which explode periodically, resembling the shot of a gun, have been manufactured specifically for the scaring of birds. Robins, however, soon become accustomed to these and sometimes perch fearlessly near the devices while they are exploding. Firecrackers attached along a dangling fuse which burns slowly are effective in causing a loud report every few minutes to scare birds from a fruit planting. Aerial bombs throwing missiles which, in turn, explode while in flight are also effective.

A cat which is accustomed to a collar tied to a string can be very useful in a small strawberry patch to frighten birds away. Cats have been placed in a cage in a cherry tree to save the crop.

Birds fear the image of a hawk. I Holland, a stuffed hawk tied to a nyl string 100 feet long and whirled over cherry orchard from a tower prevente damage to eight acres of cherries.

Cross-hatching of twine over ber bushes confuses birds when it is fir erected and in their confusion they sta away, but they soon learn how to f down through between the twines. Mi nets of very fine strong thread have bee used successfully over highbush bluebe ries. The net is so fine that the birds a unable to see it and they get caught i it. The fact that birds other than tl destructive species also are caught is drawback of this method.

A narcotic, alpha-chloralase, has be used successfully on wood pigeons i France. Upon eating bait containing tl narcotic, the birds become dazed or u conscious for a period and harmful sp cies can easily be caught. The use poisoned bait is common knowledg Spraying endrin, dieldrin, parathion TEPP on dormant trees from which bir are removing fruit buds has been effectiv in killing birds in England. *Poisonin should be done only with public approv and under official supervision.*

Repellents

The use of repellents has been teste extensively. Devices to repel birds fro a fruit planting can be based on the var ous senses of the bird: sight, taste, smel hearing or touch. Visible patterns suc as eye-like patterns on large butterfli are frightening to birds. Experimen have shown that birds can taste, althoug the sense of taste is much less responsiv in birds than it is in man. If ripenin fruits could be sprayed with a chemic which man could not taste but which wa offensive to birds, this might be very us ful. Effective chemical repellents must b non-toxic to man; they must not spoil th taste or appearance of the ripe fruit they must retain their effectiveness fo reasonable periods after application; an they must be inexpensive and easily ap plied. These specifications for effectiv

chemical repellents are so exacting that progress along these lines appears difficult.

The sense of touch in birds has been effectively employed. Wires coated with an adherent gummy material and stretched high over vineyards have been effective in repelling birds. Birds first perch on the high wires before dropping down into the vineyard to feed; the gummy substance on their feet frightens them away.

Spirolum whirlers made of shiny foil similar to those used in advertising by gasoline stations, have been effective repellers when stretched over blueberry plantings. However, birds soon become accustomed to these; they quickly lose their effectiveness. Strips of aluminum foil tied to limbs of trees of ripening cherries have a similar effect.

In Germany in an area where large flocks of starlings roosted in fields of reeds near cherry orchards, the birds did not return after they had been driven out three successive evenings by helicopters equipped with flashlights flying over the area.

Destruction of nests of harmful birds has been effective on a small scale in England. This method of control requires the cooperation of a large number of persons over a definite area of land and its limitations are obvious.

Location of Orchard Important

The location in which fruits are planted can be an important factor in the control of birds. Cherry orchards and blueberry plantations which are near a woods are particularly susceptible to bird damage as the birds use the woods for hiding. Hedges growing near small fruit plantings provide a hiding place and the fruit is vulnerable to bird damage. Birds prefer ripe mulberry fruits to sweet cherries which ripen about the same season. A large fruiting mulberry tree near a cherry orchard has been known to tend to prevent bird damage to the cherries.

Bird traps have been used successfully. Their success is dependent on the proper choice of baits which attract mainly the destructive species. Traps constructed of wood frames 9 feet square and 7½ feet tall and covered with chicken wire have been useful during harvest season in catching thousands of starlings in cherry orchards in New York and Ontario. Traps are expensive to operate because they must be visited daily. Traps made of netting in the shape of a large funnel with a strong light at the bottom of the funnel used at night have made it possible to catch thousands of birds at a time.

Phonograph records of distress calls of starlings have been made. Amplified and replayed back into the orchard, the recordings frighten starlings away. Species other than starlings are not frightened by the starling call. Even starlings become accustomed to the call and, after two weeks of use, its effectiveness may diminish. In England where the use of distress call recordings is illegal, recordings of the flapping of wings such as that heard by a flock of birds flying up in unison from a field have been effective.

Electric shocking devices which do not kill the birds, installed on posts above a field over fruit plantings, are effective in disrupting birds approaching a fruit planting. This technique has been used in commercial elderberry plantings in New York.

Fruit growers, as evidenced by their very occupation, are lovers of nature, including birds. They have no desire to indiscriminately kill large numbers of birds. Their only purpose in controlling birds which destroy their crops is to try to obtain the most profit for the fine fruit which took so much care to produce. Sometimes the fruit growers' purposes conflict with those of the conservationist. It will be necessary for both interests to compromise in order to solve a common, though sometimes conflicting, problem.

Methods to control birds, although rather limited in effectiveness at present, in the future will undoubtedly be based on the specific habits of each species to be controlled. In order to determine specific habits, each kind of bird requires a detailed study. Only through intensified research on the biology of birds can the best control methods be developed.

PRUNING FRUIT TREES, VINES, AND BUSHES

J. R. Magness

TO MANY home gardeners pruning seems to be one of the most puzzling and difficult of cultural practices in growing fruits, but if certain basic principles are kept in mind it is possible for even inexperienced growers to do a satisfactory pruning job. The purpose of pruning is to develop the tree so it will have maximum strength for bearing and carrying a good crop of fruit. A safe rule to follow is to prune as little as necessary to accomplish this purpose.

When to Prune

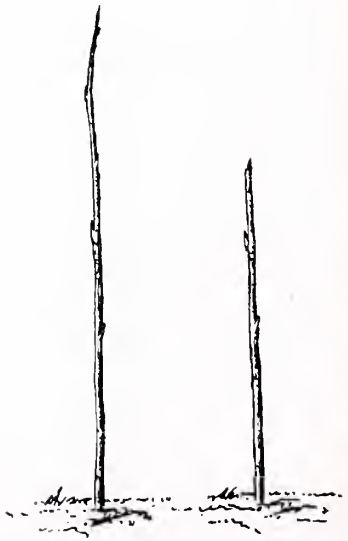
Pruning of fruit trees in general should be done during the dormant season, preferably in spring after danger of severe frost is over but before growth has begun.

Pruning Young Trees

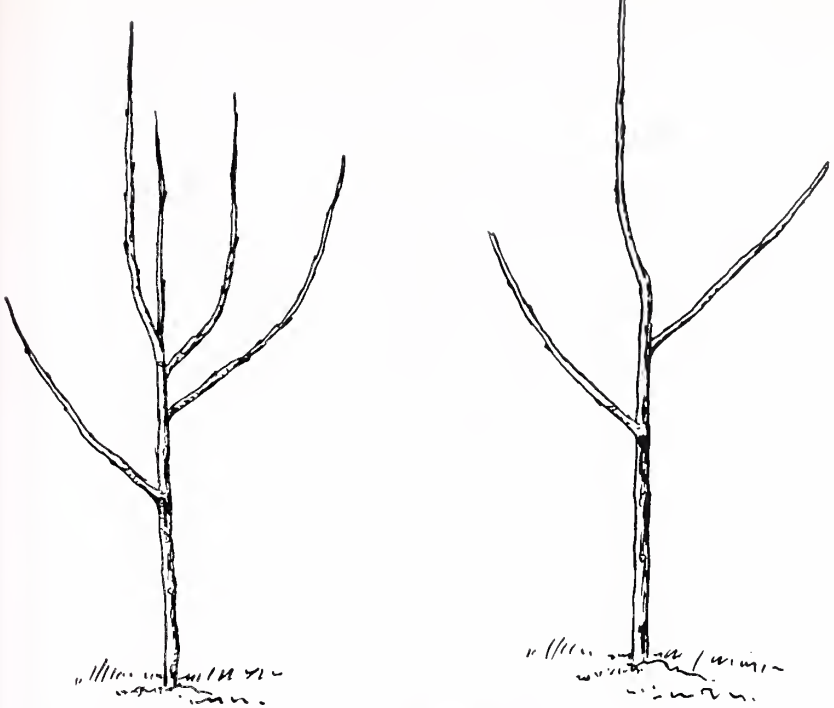
The first pruning should be done at the time the trees are planted. If they are just unbranched whips, this pruning consists simply of heading them back to a height of 3½ to 4 feet. If the trees are branched, certain of the branches are selected to be the framework of the tree, the others are removed. In general, the branches which are kept should point in different directions, and should be at least 6 inches apart along the trunk. Not more than three or four such branches should be left.

Peach trees are often well-branched when received from the nursery. Such trees are headed back to about 5 feet, and the side branches cut back to spurs, taking care that at least one well developed leaf bud is left on each spur. During the growing season these buds will produce branches, and from these are seselected the framework branches, the others being removed. Pruning from this time until the tree comes into bearing will be mainly for purposes of training. As the tree develops and the branches increase in number and size a little corrective pruning is likely to be needed. Crowded limbs and parallel branches should be corrected by removing the less important branches. Occasionally a limb may outgrow the others and have to be cut back to keep the tree reasonably symmetrical, though very little heading back should be done until later in the life of the tree; and even then the heading back will probably be for the purpose of thinning the fruit or stimulating new growth at local points.

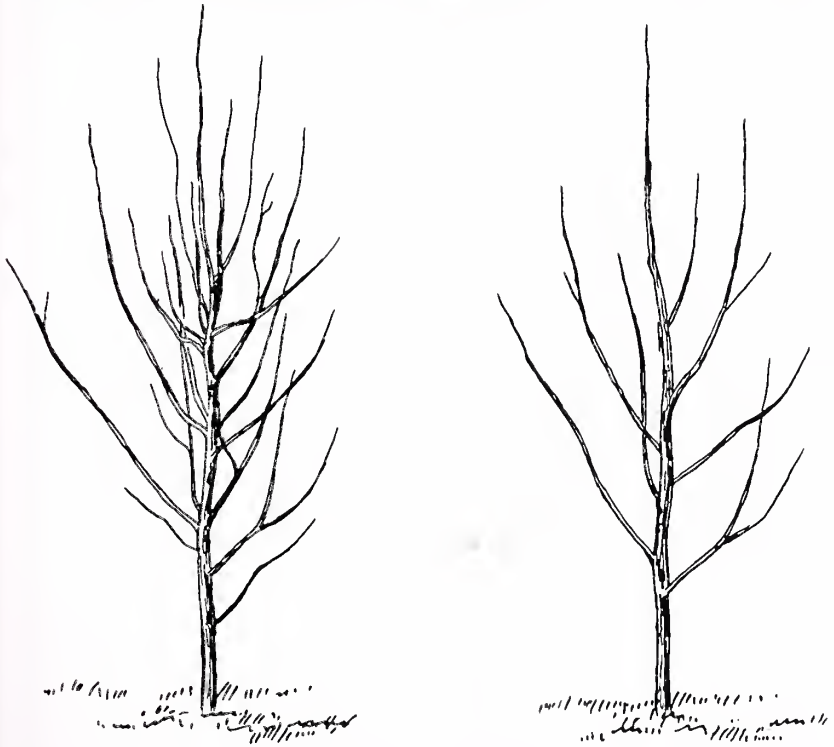
For fruit trees in general the topmost branch should be one making a somewhat stronger growth than any of the lower branches. If the branches are well spaced along the trunk, the trunk will be of a larger diameter than the branch which rises from it. Such a union between trunk and branch gives the strongest possible crotch.



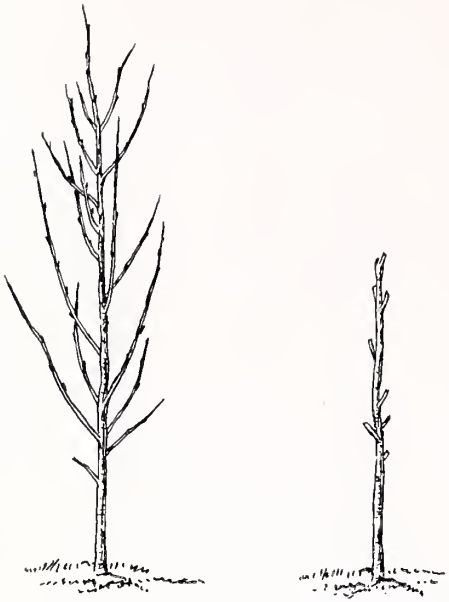
Whips are simply headed back when planted



At planting time, branched trees are pruned to three or four scaffold branches



Apple tree after second season of growth in orchard before (*left*) and after (*right*) pruning



Well-branched, year-old peach tree as received from nursery (*left*), and after it was pruned (*right*)

Same tree several weeks after it started growth (*left*) and after all branches but those selected for framework of tree were cut off (*right*)

After the second spring and until the trees are in bearing condition, pruning should consist simply of a light thinning-out each season. Overpruning of trees through this stage is far more serious than underpruning. If the trees are well shaped and the scaffold branches well selected during the first two years, no great harm will result if little pruning is done during the years following, until the trees are well into bearing.

Pruning Bearing Trees

In general, peach trees require much heavier cutting than apple or pear trees if they are to be kept in satisfactory bearing condition. The fruit of peach trees is borne on the previous season's growth, and it is necessary that strong growth should develop each season to keep the trees in satisfactory producing condition. If too much bear wood is left on the trees during any season, the growth made the following season is reduced and production the next season thereafter will be correspondingly reduced. Therefore it is good practice to give peach trees a fairly heavy pruning each spring in order to maintain them in vigorous condition.

This pruning in peach trees should consist of thinning out shoots and heading back to reduce the fruit-bearing surface. Much thinning of the peach crop is done by pruning. Such pruning should be delayed until the condition of the buds can be determined in the spring. Frequently peach fruit buds are killed in part or entirely by low winter temperatures. If only a few buds are alive in the spring, little pruning should be done that year.

Apple and pear trees produce fruit primarily on spurs which may be on relatively old wood. Therefore the bearing surface does not need to be renewed each year, as with peaches. Consequently apple and pear trees require only a light annual pruning after they have come into bearing, in order to prevent the top from becoming too thick and bushy and to facilitate spraying and other orchard operations. If the pruning is done each year, it should consist only of a light thinning out, removing primarily the

weakest-appearing or thinnest wood. A thorough pruning of bearing trees once in three or four years is usually ample, although a light pruning each year is preferable.

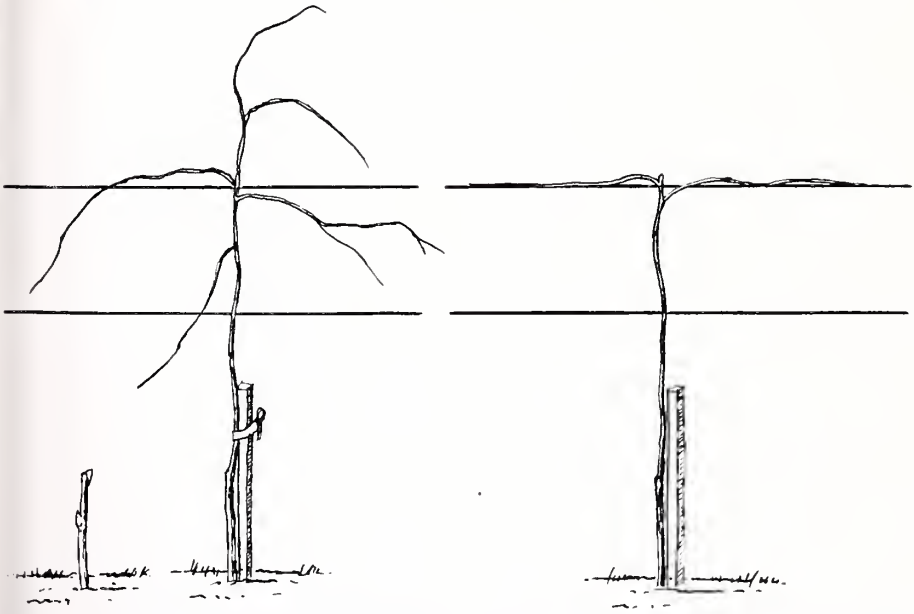
The shape that a tree will assume is determined largely by the characteristics of the variety. It is impossible to change these natural tendencies greatly by pruning treatments, and, in general, it should not be attempted. The tree should be given plenty of space to develop its natural form. The most important consideration in the whole life of a tree from the standpoint of pruning is to make the proper selection of branches spaced at considerable intervals up and down the trunk during the first year or two after the tree is planted. During the bearing life of the tree, pruning can be used to thin out the top and give better quality fruit with better color and size than results if the tree is unpruned. Overpruning, however, is always a more serious mistake than underpruning; throughout the life of an apple or pear tree cutting should be held to a minimum.

The pruning of cherry, plum, and apricot trees involves the same general principles as the pruning of apple and peach trees. The habit of fruiting of different kinds, and, to some extent, of different varieties, may in some cases determine the details of pruning. If a cherry tree is making a very strong annual growth, slight heading back will usually help to stimulate the development of fruit spurs.

The apricot produces most of its fruit on short lateral branches that develop from the older wood. Pruning with a view to the development of an abundance of these lateral shoots and the maintenance of their vigor becomes one of the essential features in the management of apricot trees. Under some growth conditions slight heading back of the annual growth or even cutting back the bearing lateral shoots will help to develop and maintain an abundance of bearing wood.

Pruning Grapevines

At the time of planting, grapevines are usually cut back to one or two buds. If



When planted, grape vines are pruned back to one or two buds (*left*); after vine develops first year, two branches are selected and trained to upper of two wires (*right*)

During second year many branches develop on grape vine. In addition to two lateral previously trained to top wire, two more are trained to lower wire; others are removed

they make a very strong growth during the first season, this growth can be tied up to a stake to form the trunk of the vine. If the growth is rather weak during the first season, it is preferable to cut back at the end of the first growing season again to one or two buds and to train up a strong trunk during the second growing season.

If the vine is to be trained to a fence or a 2-wire system, it should be tied to a stake and carried upright until it reaches the top wire. At that point it should be pinched off and two laterals led out, one in each direction, along the wire.

During the following season, lateral canes will grow from all the buds along the trunk. Two of these at the height of the first wire above the ground should be selected and tied to the wire to develop fruiting wood. The other branches along the trunk should be rubbed off or pinched back during the growing season.

After the vines attain this form, pruning will consist in saving one strong lateral and tying it along each wire each growing season. All other laterals will be removed except that short spurs should be left to grow the fruiting cane for the next season.

More wood may be left on vines for home production, provided sufficient space is available for the vine to develop. With vigorous vines, the leaving of more wood would result in a greater total quantity of fruit, although the individual bunches may be inferior in size and quality. The type of pruning outlined is essentially that followed in most commercial vineyards in the United States, except in California. For pruning of grapes in California, see page 62.

Pruning Raspberry and Blackberry Plants

The pruning of raspberries and blackberries consists of removing the old fruiting wood each season. This wood may be removed immediately after the crop is harvested, or it may be left until the dormant season. In most parts of the United States it is preferable to remove the old wood immediately after fruit harvest, so as to prevent the crowding of the new canes by the old and to prevent the spread of disease from the old canes to the new ones. These old canes should be cut off close to the ground, and the new canes will then develop strong growth to produce fruit for the following season. With raspberries, both black and red, it is frequently desirable to tie up the new canes, either between wires or to stakes, to support them off the ground. Blackberry and dewberry canes should also be tied up to stakes or to a trellis, but canes of all varieties of bramble fruits not completely hardy may be left on the ground,

where they will have some snow cover, or else will be covered with soil until spring. They should then be tied up to stakes or to a trellis prior to the starting of growth in the spring. If raspberries and blackberries make a very strong growth and develop a large number of canes, it is frequently desirable to thin out the number of canes to six or eight per hill during the dormant season.

It is generally desirable to cut off the tips of the young shoots of black raspberries when they reach a height of 18 to 24 inches. This induces branching and results in more satisfactory total production. Red raspberries and blackberries usually are not cut back during the growing season. If the red raspberry canes make a growth in excess of 5 feet, it is sometimes advantageous to tip them back to about that height in the spring prior to the starting of growth.

Pruning Gooseberry and Currant Bushes

Canes two and three years of age produce the most satisfactory gooseberries and currants. In general, the pruning of these fruits will be limited, during the first two years, to thinning out the bushes if more than eight or ten shoots have developed. After the planting is three or four years old, a systematic cutting out of the oldest wood each season is desirable, leaving young shoots to replace this old wood. This should be done during the dormant season.

Wounds Caused by Pruning

The manner in which pruning wounds are made determines to a large extent the readiness with which they heal. A stub of any considerable length left in cutting off a branch never heals. The wound made in cutting off a branch close to its supporting limb will ordinarily begin healing over at once, or as soon as the tree renews its growth if the pruning is done during the dormant season.

Treatment of Pruning Wounds

Probably the most important treatment for pruning wounds, where any is needed, is to keep the exposed surface in an aseptic condition. If the wounds on a tree that is sprayed with a fungicide several times a year are thoroughly coated with the fungicide each time the tree is sprayed, the danger of infection from decay-causing organisms is much reduced, if not eliminated. Small wounds that heal over in two or three years are not likely to need any other treatment.

There is, in fact, some question as to the advantage of applying any other than the fungicidal treatment to pruning wounds regardless of size. Some of the results of experimental work indicate that undressed pruning wounds have healed more rapidly than those that have been treated. Large wound surfaces should be treated to prevent decay.

Many substances have been tried and variously recommended, but none is fully satisfactory. Among these substances are white lead paint, shellac, water glass, grafting wax (either liquid or solid), a coal-tar creosote mixture, and others, including many proprietary preparations. Practically any covering employed will need to be renewed from time to time in order to be effective.

If white lead paint or coal-tar creosote mixture are used, they should not be applied to the outer rim of the wound where they will cover the cambium, which is located just underneath the bark. Healing will be retarded if that is done. Shellac may cause little or no injury, but rather frequent application seems necessary if the surfaces are to be kept well covered. Water glass at full strength or diluted, 75 per cent of water glass and 25 per cent of water by volume, gave promising results in experimental work carried out in Ohio on muscadine grapes and silver maple trees. These treatments appeared quite effective in preventing bleeding.

The bleeding of a pruning wound, that is the flow of sap from it, which sometimes occurs, especially if the wound is made late in the spring, need cause no worry. It is comparable physiologically to the flow of sap when a sugar maple is tapped in sap time.

PRUNING EUROPEAN GRAPES

Reid M. Brooks

EUROPEAN grapes, the grapes grown mostly in California, are often grown and pruned in a manner sufficiently different from that employed in the culture of other kinds (see page 60) as to warrant a separate discussion.

Pruning young European grape vines. The first year after planting the vine is allowed to grow undisturbed. At the first dormant pruning, all but one strong cane are pruned off and this is cut back to 2 or 3 buds. Thereafter, the vines are trained and pruned to various systems according to the fruiting habits of the different varieties.

Head pruning is used for varieties that fruit well on short spurs, among which are 'Muscat of Alexandria,' 'Muscat Hamburg,' and most wine grapes. A head-pruned vine has a trunk 1 to 3 feet high bearing a ring of short branches or spurs. During the second growing season after the 2 or 3 buds have made a few inches growth, the strongest is trained along a stake, and tied loosely; the others are removed. Laterals on these canes that outgrow the head are cut back to slow their growth. The upright cane is headed by cutting off the tip when it is a foot above the height chosen for heading.

During the third season all suckers and buds on the lower half of the trunk should be removed, those on the upper half being allowed to grow unchecked.

At the third winter pruning 3 to 6 canes are selected and cut back to spurs of 2 to 4 buds each according to the size of the canes. These will be the fruiting spurs, and they should be as near the top of the vines as is practicable.

In succeeding years the number of fruiting spurs is increased until old large-headed vines have 10 to 20 spurs and appear like the vine on page 63.

Cane pruning is used for varieties such as the 'Thompson Seedless' that have mostly unfruitful buds near the base of the canes, or for varieties with very small clusters such as 'Cabernet Sauvignon,' the 'Rieslings' and the 'Pinots.'

With cane pruning a trunk is developed similar to the trunk in head pruning. The head of the vine differs in being fan-shaped in the plane of the trellis. Cane-pruned vines are trained to a simple two-wire trellis consisting of a 6 foot stake at each vine with wires 3 and 4 feet from the ground.

At each annual pruning after the vines are in full bearing, canes with 8 to 15 buds (2 to 5 feet) are retained for fruiting. All other canes are removed except some renewal spurs of 2 buds each left near the base of each fruiting cane to produce canes for the following year.

Cane-pruned vines tend to overbear, so some of the clusters should be removed after fruiting.

Cordon training, a third method, is used for table grape varieties such as 'Cardinal,' 'Emperor,' 'Malaga,' 'Red Malaga,' 'Ribier' and 'Tokay.'

A two-wire trellis with the wires 3 and 4 feet above the ground is used for support. During the second summer the vines are allowed to grow unheaded, but the main shoot and a strong lateral are chosen about 10 inches below the trellis wire to which the cordon is to be trained. All other laterals are pinched back. These selected canes are brought up to the trellis wire from the trunk in a smooth curve of 6 to 8 inch radius and tied in opposite directions along the wire to form the cordon. As they continue to grow they should be tied loosely to the wire.

Dormant pruning at the end of the sec-

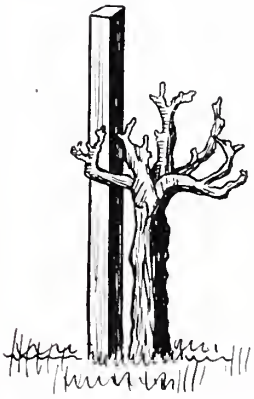
ond season should have the lateral arms cut back to a point where they are one half inch in diameter.

During the third season all suckers and buds developing on the lower side of the cordon should be rubbed off as they appear. New growth on the trunk and arm bends should be removed.

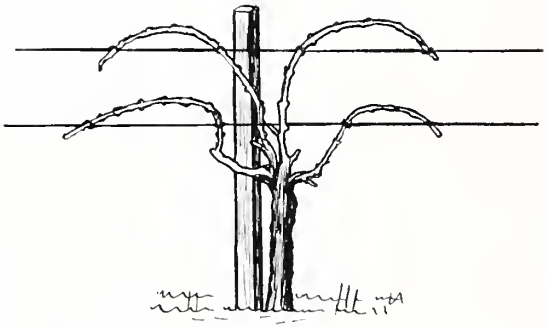
Shoot growth from the upper side of the arms should be tied to the upper wire so that the weight of the new canes and the foliage will not turn the cordon arms over. If the vine appears to be bearing more fruit than the vigor of the vine indicates that it should, many of the bunches should be removed as soon as possible.

The cordon-trained vines in full bearing are pruned to leave fruiting spurs spaced 8 to 12 inches apart along the cordon arms. The spurs are cut back to 2 or 3 buds depending on cane vigor.

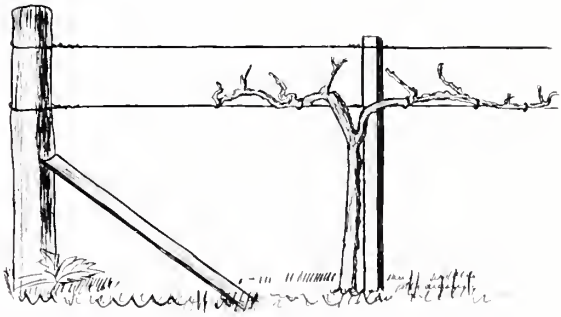
During the growing season strong canes from the fruiting arms should be tied to the upper wire. Growth on the trunk should be removed as it appears. Overbearing should be prevented by cluster thinning.



Typical mature, head-pruned vine, headed at about 24 inches



Mature, cane-pruned vine on simple 2-wire trellis



Mature, horizontal, bilateral, cordon-pruned vine

HOW DWARF FRUIT TREES ARE PROPAGATED AND GROWN

Karl D. Brase

TREE fruit varieties are propagated on seedling and vegetatively propagated clonal root stocks*. Seedlings, as the name implies, are grown from seed while clonal stocks are the vegetative offspring of individual selected plants. Seedling rootstocks, except those of certain stone fruit species, induce vigorous growth and produce large trees. To produce the so-called dwarf apple or pear trees selected clonal rootstocks that dwarf the variety propagated on them must be used.

Restricting the growth of fruit trees by the use of size-controlling clonal rootstocks was known centuries ago. As early as the 16th century the so-called 'Paradise' and 'Doucin' rootstocks were mentioned as possible dwarfing media for apple trees. From these rootstocks some thirty clonal lines were developed that produce trees ranging in size from true dwarfs to trees more vigorous than those grown on seedling rootstocks. Rootstocks that dwarf other tree fruit varieties have been developed.

*A specific clonal rootstock consists of the asexual offspring of a single selected plant.

Dwarfing Apples

The best true dwarfing rootstock for the apple is still a selection from the old 'Paradise' that is now known as *Malus* EM IX. This stock is reasonably hardy, fully compatible with our cultivated apple varieties, and produces a small early-bearing tree. The root system is brittle and breaks easily; therefore, the newly planted tree should be supported by a stake or grown on a trellis. Field trials with trees on EM IX, however, have shown that the length of the rootstock portion of the tree can have a marked influence on preventing root breakage. A tree having a longer rootstock portion can be planted deeper, but still have the variety/rootstock graft union just above ground level. In other words, by deeper planting, root breakage can be prevented and staking is not necessary.

Root breakage may also be prevented by interposing a short piece of EM IX between a well anchored vigorous clonal or seedling rootstock and the fruit-bearing top variety. This is done by grafting an EM IX scion 6 or 7 inches long to the rootstock in early spring and later in summer inserting the varietal bud near the tip of the previous graft. When so used as interstock, the dwarfing effect of EM IX is not as great, but the resulting tree will remain small enough for garden use.

If trees of approximately half the size of standard large trees are desired, *Malus* EM VII rootstock can be used. This rootstock now is used to a large extent in commercial orchard plantings.

Pears

Pears are dwarfed by propagating them on quince (*Cydonia*) roots as there is no suitable pear rootstock with a dwarfing effect on the scion variety.

The quince clone known as 'Angers' type A is the preferred dwarfing rootstock for pears. This rootstock is reasonably winter hardy, tolerates excess soil moisture, restricts growth of the pear variety grown on it, and induces fruit production at a younger age. Dwarf pear trees are not reliably winter hardy where winter temperatures of below −10°F. are experienced every winter, particularly if these temperatures occur when there is little or no snow cover.

Author courtesy

Ten-year old 'Golden Delicious' apple tree dwarfed by grafting on "East Malling IX" stock

Since the pear dwarfing rootstock belongs to a different genus, not all pear varieties will make a strong graft union with this dwarfing rootstock. Thus, certain pear varieties such as 'Bosc' and 'Clairgeau' either fail completely or make very poor growth. Others, such as 'Bartlett' and 'Clapp's Favorite,' unite but make a poor graft union and consequently break off easily at the point they were grafted. In contrast, varieties like 'Duchess of Angouleme,' 'Hardy,' and 'Old Home' grow well on quince roots. For this reason these three varieties can serve as an interstock to make it possible to grow varieties that otherwise are completely incompatible or make insecure graft unions.

The variety 'Old Home,' which bears small pears of low quality, is a particularly suitable interstock because it is fire blight resistant. The home gardener wishing to grow pears as dwarf trees might plant an 'Old Home' tree on a quince rootstock and graft onto it two varieties that normally fail to do well on the quince rootstock, as for instance 'Bartlett' and 'Bosc.' The terminal leader branch might be grafted to 'Bartlett' and two or three lateral branches to 'Bosc.'

Since pear varieties require cross-pollination in order to set fruit, such a tree having two varieties grafted to it would insure a fruit set even when only a single tree is present.

Stone Fruits

Dwarfing rootstocks for stone fruits are still in the experimental stage and some of the stocks to be discussed here are not in general use by the commercial plant propagator.

Sweet cherry trees can be restricted in growth by grafting them to a one-year-old trunk of a sour cherry such as 'North Star.' This variety gives us a small tree,

Author courte

Branches of this dwarfed 'McIntosh' bend down under load of fruit

even when grown on the conventional cherry rootstock such as *Prunus mahaleb* seedlings. Correspondingly it also restricts the sweet cherry variety grafted on it. Seedling rootstocks of *Prunus fruticosa* have induced a strong dwarfing effect and earlier bearing of sweet cherry varieties bud-grafted to them. At present this particular dwarfing stock is still in very short supply but eventually it may become available and thus make it possible to grow sweet cherries as true dwarf trees.

Peach varieties can also be restricted in growth and dwarfing rootstock choices can be (1) seedlings of the Manchurian apricot (*P. armeniaca* var. *mandchurica*), (2) the Western sand cherry (*P. besseyi*) and (3) the Nanking cherry (*P. tomentosa*). The last of these appears particularly desirable, because it does not sucker from the root system as *P. besseyi* commonly does. A clonal stock, 'St. Julie plum type A, has also been suggested a a possible dwarfing stock for peach, b this stock is more difficult to propaga vegetatively than the three seedling roo stocks mentioned.

Plum and prune trees can successfull be grown as dwarf trees when *P. besse* is used as the root system. Most succes ful have been the prune varieties 'Italia Prune' and 'Stanley,' while the Japane plum varieties such as 'Beauty,' have gi en a small, productive tree on this dwar ing stock.

Important Points

Since dwarf trees must be grown o root systems that restrict vegetati growth, it is important that such trees b planted correctly. Dwarf trees plante with the varietal/rootstock graft unio below ground level will soon becom

Dwarf pear tree
McFarland

scion-rooted. The varietal trunk will develop its own root system and in this way will free itself of the dwarfing rootstock. Such scion-rooted trees resume strong vegetative growth. It is, therefore, necessary that on propagation the varietal bud graft is placed not at ground level as normally is done, but 4 to 5 inches up on the rootstock trunk. On transplanting such trees to their permanent location they can be planted deeper but still must have the graft union slightly above ground level so that scion rooting cannot take place. Trees with a longer rootstock portion planted correctly need no support. There also are indications that sucker growth arising from the rootstock is suppressed where correct deeper planting is practiced.

The home gardener wishing to grow dwarf apple trees might also consider only varieties that are not too susceptible to fungus disease, such as apple scab. Highly susceptible varieties are 'McIntosh' and 'Cortland' while 'Lodi,' 'Yellow Transparent,' 'Red and Golden Delicious,' 'Baldwin' and 'Wealthy' can with a somewhat limited spray program be grown more easily. When purchasing dwarf trees the buyer should not only specify the variety but also the rootstock on which the variety is to be grown.

All fruit trees require a sunny location and dwarf trees in particular should only be planted in a fertile soil. If these points are considered, dwarf trees can be successful and give the home gardener much satisfaction.

FRUIT VARIETIES FOR THE HOME GARDEN IN THE NORTHEAST

John Einset

MANY thousands of fruit varieties exist and new ones are constantly being introduced. The proper choice may be extremely important in determining the success of the home grower.

Generally those varieties that are commercially successful have undergone years of trial and are also to be recommended for the home garden. However, some of the choicest, which may be highly desirable for the home garden, may have such faults as low production, short "shelf life," or poor appearance that preclude successful large scale commercial plantings.

Fruits are often grown in imperfect soils and under cultural conditions far from optimum. Varieties that have the inherent vigor to tolerate less than ideal conditions and that have some resistance to diseases, insects, and climatic adversities will more likely prosper under the care received in the average home garden.

The following commonly available varieties are considered most likely to be successfully grown in the Northeast.

Small Fruits

Strawberries. Whenever possible healthy, virus-free plants from reputable sources should be planted.

'Midland,' one of best of the early strawberries for vigor, size, quality, and production.

'Catskill,' the most productive of all. A bright red, attractive, large, midseason berry.

'Empire,' another beautiful, large light red berry of good quality that ripens in midseason.

'Sparkle,' late, excellent in quality and very popular for freezing. Vigorous and productive, resistant to the red stele ro fungus.

'Fletcher,' a recent introduction wi superb dessert quality. Outstanding f freezing.

The everbearing variety, 'Gem' ('S perfection,' 'Brilliant') is the best co mercially available berry producing fall crop. 'Ogallala' is new and good the Great Plains area.

N.Y. 547, a promising high qualit variety, will soon be named and intr duced.

Red Raspberries. 'Newburgh' ripe first, a large firm berry free from m saic disease.

'Latham,' one of hardiest, most vigo ous and most reliable croppers, of fa quality.

'Taylor,' excellent for home garde and market, handsome, of fine qualit

'Milton,' attractive, bright, late ber that remains free of mosaic.

'September,' the best of the autum fruiting or "everbearing" sorts. The fa crop is especially good in quality.

'Amber,' named for its color, is recom mended for the home garden for i excellent dessert quality.

Black Raspberries. 'Bristol' and 'Du dee,' the principal commercial varieties i Central New York. They are vigoro and productive with fruit of good qualit

Purple raspberry varieties result fro crossing red and black raspberries. The are prized for canning and preserves.

'Sodus' and 'Marion' are recommende The former ripens about a week earlie

Blackberries. 'Eldorado,' if it can be ob tained true-to-name, is a fine old variet

'Bailey' and 'Darrow,' recent introduc tions that may prove to be most satis factory.

Currant variety 'Red Lake'
McFarland

Currants. 'Red Lake' is an excellent red currant for home use, with large, well filled clusters.

'Wilder,' a very productive, commercial sort.

'White Imperial' is the best white variety, although 'White Grape' is more commonly available.

Gooseberries. 'Poorman' is an excellent gooseberry and 'Downing' the best green variety.

Blueberries. Recent introductions that appear to be superior to the older kinds are to be recommended. These have been selected for large berry size, better quality and higher yield.

'Earliblue' ripens very early. 'Blueray,' 'Bluecrop' and 'Berkeley' are outstanding midseason varieties. 'Herbert' ripens late with 'Coville,' latest of all, a full month after 'Earliblue.'

Grapes. The standard commercial grapes of the Northeast are descended from the wild American vines of the area. Some newer introductions more closely resemble the European or California-type grapes.

'Ontario,' a very early white, distinctly American.

'Seneca,' an early white, nearly pure European type of the very highest quality.

'Buffalo,' a midseason blue dessert grape with delicious eating quality.

'Delaware,' the standard red variety, excellent quality, sometimes lacking in vigor.

'Niagara,' the standard midseason white, American, vigorous and productive.

'Concord,' the standard black grape for juice and jelly, hardy and productive.

'Alden,' a good, blue European type dessert grape in Concord season.

'Steuben,' the finest of recent introductions, vigorous, productive, delicious spicy flavor.

Several recent, white seedless introductions may be worthy of trial in areas where winter temperatures are not too severe. 'Interlaken Seedless,' and 'Himrod' are early. 'Romulus' ripens in midseason.

Tree Fruits

Apples. It is suggested that apples be grown on dwarfing rootstocks in order to keep the trees relatively small and to hasten fruiting. Small trees are more easily sprayed and harvested and produce a higher percentage of well-colored, high quality fruit.

The following varieties will provide mature fruit from mid-July to late October. Varieties particularly subject to disease or otherwise difficult to grow have been omitted.

Summer Varieties

'Stark's Earliest,' a very early dessert type.

'Lodi,' an early green variety, highly esteemed for sauce.

'Melba,' the highest quality early dessert apple.

Fall Varieties

'Gravenstein,' a fine quality dual-purpose variety. Several color sports are available and are usually preferred. The 'Mead Red Gravenstein' is particularly attractive.

'Milton,' very attractive, good quality for sauce and dessert.

'Barry,' resulting from the cross 'McIntosh' x 'Cox Orange' is essentially a home garden variety, valued for both dessert and culinary uses.

Winter Varieties

'Cortland,' an excellent variety for dessert, pies and for salads.

'Idared,' a fine late-keeping general purpose variety.

'Golden Delicious,' a high quality yellow dessert type, requires heavy thinning to attain good size and best quality.

'Northern Spy,' an old favorite of very high quality for both dessert and culinary uses. This variety should be grown on a dwarfing rootstock such as 'EM VII' or 'EM IX' to encourage early fruiting.

Pears. Most pears for best quality must be harvested when still firm and ripened at 65°F. or cooler and at a high humidity.

'Clapp Favorite,' the earliest commercial sort, large, good quality, short season.

'Worden Seckel,' small russet, good, ripens on tree.

'Bartlett,' the most important commercial pear for fresh and processing use, large, distinctive flavor.

'Seckel,' small, midseason, of highest quality as fresh fruit or spiced or pickled, ripens on the tree.

'Bosc,' a large, late-keeping pear of excellent quality.

'Dumont,' a late, attractive, high quality variety for the home orchard.

Peaches. The following are excellent yellow-fleshed peaches that ripen from very early through midseason: 'Sunhaven' 'Redhaven,' 'Triogem,' and 'Sunhigh.'

'Elberta' is late ripening, the most widely planted commercial variety.

'Rio Oso Gem,' an excellent late variety

Good white-fleshed varieties are 'Erly Red-Fre,' 'Raritan Rose' and 'Red Rose'

For the colder areas 'Prairie Dawn' 'Oriole,' and 'Veteran' are more hardy varieties.

Cherries. 'Montmorency,' the standard red sour or tart, pie cherry.

'English Morello,' a sour cherry with colored juice, a dwarfish tree.

The best sweet cherries include:

'Early Rivers,' an early, attractive crimson-black variety, superior to 'Black Tartarian' in quality and production.

'Emperor Francis,' the finest white or light red cherry, high quality, midseason

'Schmidt,' a large, black, standard mid-season sort.

'Windsor,' a dark red, the standard late sweet cherry.

The Duke cherries are intermediate between the sours and sweets in fruit characters. 'May Duke' and 'Royal Duke' are prized in Europe.

Plums. Of the prune-type plums 'Stanley' does best in the Northeast. It is replacing 'Italian Prune' ('Fellenberg') long the standard commercial variety.

The Gage plums are of highest dessert quality and good for jam. 'Reine Claude,' a clingstone and 'Green Gage,' a free stone, are outstanding representatives of this group.

Damsons are small, blue, tart plums prized for jam and preserves. 'Shropshire' is commonly available.

The Japanese varieties have perfumed flesh, are used for eating fresh and are not suitable for culinary purposes. 'Shiro' is an attractive, early yellow with fair quality. Others are 'Burbank,' a productive variety, and 'Santa Rosa,' a standard shipping variety of this type.

FRUIT VARIETIES FOR HOME GARDENS IN THE MIDDLE WEST

H. C. Barrett

HOW are fruit varieties selected for the home garden? The various nursery catalogues are often the first contact with fruit varieties encountered by the gardener but these are of little help, for the bewildering array of colored pictures, testimonials, patent statements, and other merchandising gimmicks offer few facts for varietal selection. The illustrations are usually over-size reproductions, often of a few basic varieties transposed from right to left or vice versa and colored or labeled differently according to the occasion. A glance at the descriptions will only lead to the conclusion that all of the varieties offered are excellent in every respect and that unqualified success awaits the grower. With all this before him the gardener often enters into home fruit growing on an appreciable scale and with high expectations only too often to find unsatisfactory results and disillusionment after a few years of diligent effort.

Many factors may contribute to unsatisfactory results and poor choice of the varieties grown may be a vitally important one. The home fruit grower has a reasonable right to expect better quality than the average market offering but if a variety does not meet even this mediocre standard, if it is subject to injury by cold winters, or too susceptible to diseases and pests, then it is a poor choice. Unfortunately we can not often find a variety that combines high quality with satisfactory cultural qualities and a compromise is called for.

Most gardeners would like to grow many kinds of fruit, small fruits as well as tree fruits, and this article was prepared with this in mind. However, in all fairness it should be pointed out that the small fruits are the best choice for most home gardeners. The merits of small fruits are many—suitability for small areas, inexpensive equipment needed, early bearing age, less insect and disease troubles than tree fruits, greater variety and kinds may be grown in a given space, and, very important, the varieties may be readily changed to newer or more favored sorts in a short period of time.

The following varieties are suggested primarily for the Middle West, a region subject to rapid fluctuations in temperature, often light snow cover and drying winds in winter; and to high humidity, high temperatures and abundant but sometimes erratic moisture distribution during the growing season. These climatic conditions demand much of fruit plants and offer considerable encouragement to their enemies, especially diseases.

Small Fruits

Blackberries

'Darrow' is perhaps the best blackberry variety available for the home garden. Berries are large, glossy black, and good quality. Vigorous and productive plants.

'Bailey' is another good variety with large, attractive, sub-acid fruit.

Blueberries

In many parts of the Middle West the natural soil conditions are not suitable

for blueberries and special cultural practices will be needed to succeed with this delicious fruit.

'Earliblue' is one of the best very early varieties. Berries are medium large, firm and are very good in quality.

'Bluecrop' is an early variety of attractive color. Berries are large, firm, oblate and good in quality.

'Berkeley' is noteworthy for very large berries of light attractive blue. Quality is good and maturity is late midseason.

'Jersey' has large, good quality berries of good blue color. Vigorous, productive and late maturing.

'Coville' is a very late, productive variety with very large, good quality berries. Plants are vigorous and productive.

Currants

'Wilder' is a midseason red currant of good productiveness. Clusters and berries are large and the quality is good.

'Red Lake' is somewhat later in ripening, productive, and good quality with large fruits.

Gooseberries

'Poorman' is a vigorous productive variety with red berries of good quality and size.

'Glendale' is better adapted to high temperatures and drouth than many varieties. Fruit quality is good on a productive bush.

Grapes: American Varieties

Grapes are particularly recommended to the home gardener for their great diversity of flavor, color, and interesting qualities. The seasonal range is very great, their demands for care are relatively easy and their products are as delicious as they are diverse. The author believes that a collection of grape varieties can offer more real pleasure and enjoyment than any other fruit plant.

'Buffalo' is by all odds the best grape for the home garden. This early maturing variety has medium large clusters and blue, medium large berries of superb quality. Very vigorous and pr ductive vine with clusters that will ha on the vine until freezing weather wi almost undiminished quality. Also mak the most delicious juice and jelly ima inable. Truly a masterpiece in gra breeding from the Geneva, New Yo Experiment Station! Highly reco mended.

'Beaver' is another fine early blue v riety of very good quality. Clusters a medium, very compact with mediu large berries, the vine vigorous and pr ductive. A worthy contribution fro the grape breeding work at the Missou State Fruit Experiment Station Mountain Grove, Missouri.

'Kendaia,' an early blue grape, h medium large clusters and large berri of good quality. Vines are vigorou hardy, and productive.

'Ontario' is the best early white v riety, vigorous and productive with m dium large clusters and medium berri of good quality.

'Portland' is an early white variety medium clusters and large berries good quality. Does not keep long on t vine but good in its season.

'Delaware' is a red variety of sma clusters and berries but delicious quality.

'Concord' is the old well known bl standby variety widely grown ever where. It has only fair dessert qualit but is very good for juice and jelly.

'Urbana' is a late variety recommende for long growing season areas becau of its superb quality and keeping abi ity. The light red, large berries in b clusters are delicious to eat. It is vigorous, productive vine if carefull sprayed for downy mildew.

Grapes: French Hybrids

A comparatively new and promisin class of grapes which were bred i France for production of wine and a best adapted for this use.

'Baco No. 1' is an early blue variet of long clusters and small berries, o very vigorous and robust vines. A goo red wine variety.

'Foch' is a very early blue of medium clusters and small berries. The vigorous vines are well suited to short season areas. Excellent red wine.

'Seibel 5279,' a very early white with long slender clusters and medium oblate berries. Good to eat as well as being a good white wine variety. Very hardy and productive.

'Seibel 13053' is a very early blue with medium clusters and below medium berries. Vigorous, hardy and productive of red or rose wine.

'Seyve-Villard 5-276,' an early midseason white with compact medium to large clusters and medium berries. Fairly good to eat but recommended for its superior white wine. Very productive and hardy vine.

'Bertille-Seyve 2667' has a vigorous, productive and rugged vine with large, long, compact clusters of medium blue berries. A good red wine type.

'Joannes-Seyve 23-416,' a midseason white or pinkish colored variety with large, long clusters and medium ovate berries. Vigorous, productive and robust vine. A good white wine type.

'Seyve-Villard 12-375' is a midseason or slightly later white variety with very large, heavy clusters and large ovate berries. Good to eat with adherent skin but produces an excellent white wine. Very vigorous and productive vine. The best French hybrid variety in areas similar to central Illinois where the growing season is long enough for its maturity. Highly recommended.

'Coudere 71-20,' a late midseason blue variety with medium compact clusters and medium berries. Vine is vigorous, productive, hardy and very rugged. Produces a good red wine.

Seedless grape varieties now available, while very good in fruit quality, require more care than the varieties mentioned previously. In most parts of the Middle West they suffer from winter injury and must be carefully sprayed for diseases.

'Himrod,' a very early white with large clusters and berries, is suggested for trial in areas south of the latitude of central Illinois.

'Concord Seedless' appears to be identical to 'Concord' except clusters and berries are small. No better than 'Concord' as a dessert fruit. Vine is vigorous and hardy like 'Concord.'

Black Raspberries

'Bristol' is a good midseason variety and widely grown commercially. Berries are large, firm, glossy. Vigorous, productive plants.

'Logan,' an early variety of good quality. Medium large berries.

Red Raspberries

'Amber,' the highest quality "red" raspberry although the color of the berry is light amber. A late productive variety recommended for its superb quality.

'Latham' is a hardy midseason variety of fairly good quality. Widely planted and reliable in northern areas. **Purple raspberries** are crosses of black by red raspberries and are usually more productive and vigorous than either parent.

'Sodus' is one of the best purple varieties. Berries are large, firm, of good quality and ripen in midseason. The plants are very vigorous, productive and hardy.

Autumn Fruiting or Everbearing Raspberries

'September' is the best autumn fruiting red raspberry. Berries are red, medium in size and good in quality. Plants are productive and the autumn crop begins to ripen early enough so that a good proportion of the crop matures before killing frosts. The summer crop is very early.

Strawberries: June Bearing

'Midland' is an early variety with large berries of very good quality. The mother plants do not make many runners unless conditions are quite favorable but the individual plants are very productive. The best strawberry variety

for freezing as the frozen berries are superb in quality, color and firmness.

'Suwanee' is an early midseason variety included in this list because of its extraordinary quality. Berries are large to medium, long conic, bright red, with the highest, most delicious flavor of all strawberries. Vigorous, making runners very freely, production variable but well worth the effort if high quality is prized. Excellent frozen also.

'Fairfax' is an early midseason variety with firm, dark red to purple-red berries of very good quality. The plants are vigorous with dark green foliage and large flowers. Delicious fresh or frozen.

'Tennessee Beauty' is a late midseason variety of high production, making runners freely. Berries are medium to below medium in dry years but no variety is a more reliable and consistent cropper. The berries are firm, easy to cap, very good in quality either fresh or frozen. One of the best all around varieties.

Strawberries: Remontant or Everbearing Varieties

Not recommended unless out of season strawberries or novelties are wanted.

'Ogallala' and 'Ozark Beauty' are suggested for trial if special cultural methods are used.

Tree Fruits

Apples

'Lodi' is an early large, greenish-yellow apple that is very good for culinary purposes. 'Melba' is a red, medium large apple that is very good in quality for an early apple but prone to drop its fruit like 'McIntosh' when grown in areas with high summer temperatures.

'Cortland' is an early fall variety with large, red, good quality fruit suitable for dessert or cooking purposes. Trees are vigorous and productive annually.

'Jonathan'—a well known apple valued highly for dessert as well as culinary use. The fruit is medium in size, bright red and of excellent quality. Th tree is an annual bearer, productive bu very susceptible to fire blight.

'Golden Delicious' is one of the bes quality yellow or greenish-yellow fal apples. The fruits are large, conical aromatic and excellent for dessert. Th trees are vigorous and productive an come into bearing at an early age.

'Secor' is a high quality red appl similar to 'Jonathan' in quality but larg er and keeps bettter in storage. Th fruit has crisp, juicy flesh of high qual ity for dessert or culinary uses. Th trees are productive but very susceptibl to fire blight like 'Jonathan.'

Pears

The pear is one of our most deliciou and highly prized fruits but unfortu nately most varieties are so suscepti ble to fire blight that culture of th high quality sorts such as 'Comice 'Bartlett,' 'Bosc,' etc. can not be recom mended for most areas of the Middl West.

'Maxine' is the most blight resistan good quality pear that can be grown i this region. The pears are mediun large, pear-shaped, clear yellow wit juicy, sweet flesh. Stone cells or "grit are usually absent. Season of maturit is September but the fruits should b picked in early September. The tree i tall and upright in growth and biennia in production.

'Seckel' is the highest quality pea that can be grown with fair succes in the Middle West. Blight resistanc is fairly good and the pears are smal highly aromatic, very sweet and del cious in quality. Season of maturity i mid-September. Trees are consistent an annual producers.

Apricots

Most present day apricot varietie are not well adapted to the Middl West, primarily because of frost injur to the very early opening blossoms an injury to the fruit buds in severe win ters. None are recommended unless th gardener is content with an occasiona

McFarland photos

'Seckel' pear can be grown in the Midwest

crop of this most delicious fruit.

'Large Early Montgamet' is a high quality variety with orange flesh of delicious flavor and aroma that is excellent fresh or canned. An added advantage of this sort is the sweet kernel within the pit or stone. This kernel looks and tastes like an almond and thus two valuable crops are produced at the same time—apricots and "almonds." The fruit buds are often injured in cold winters but the tree crops as well as any commerical apricot variety in the latitude of central Illinois.

The varieties 'Henderson,' 'Moorpark' and 'Superb' are also suggested for trial.

Cherries

Sour or tart pie cherries are well adapted to most of the Middle West but sweet cherries are not well adapted and must be considered in much the same light as apricots—uncertain crops but quite delicious. Sweet cherries suggested for trial are 'Emperor Francis,' 'Hedelfingen' and 'Napoleon.' Note that 'Emperor Francis' and 'Napoleon' will not pollinate each other.

'Montmorency' is the most widely grown and prized sour cherry. The fruits are large, bright red, tart, and excellent for pies. The quality is good with yellow flesh and light or colorless juice.

'North Star' is a new variety well suited to the home garden. The tree is small in size, very hardy, productive and annual in bearing. The fruits are medium, red, exeellent for pies and have reddish-colored flesh and colored juice.

Plums: European Varieties

'Stanley' is one of the best plums for the Middle West. The fruits are large, blue, prune-shaped with greenish-yellow good quality flesh. Fine either fresh or canned. Annually produetive and comes into bearing at an early age.

'Reine Claude' ('Green Gage') is one of the highest quality of all plums. Fruits are a not too attractive yellowish-green, medium in size and of superb quality. Excellent fresh or canned as the fruits retain their shape well.

'Shropshire Damson' is highly prized for jam and jelly but not for dessert. The fruits are small, purplish black, tart with the characteristic "damson" flavor. The trees are very productive, hardy and resistant to pests.

Plums: Japanese Varieties

'Shiro' is an early, attractive yellow variety of medium size. The quality of the fruit is good and the trees are produetive.

'Burbank' is a red, medium-sized plum of good quality that is biennially productive. The tree is a flat-topped, sprawling grower. Unfortunately these two varieties will not pollinate each other an another Japanese variety such as 'Sant Rosa' or 'Methley' is suggested as pollinator.

Plums: American-Japanese Hybrid V rieties

'Underwood' is an early, red, larg sized, good quality hybrid plum. Tl tree is very hardy and productive.

'Superior' is a very large, red plu of good quality and production. One the largest hybrid plums and qui attractive. Trees are very hardy ar productive.

Plums: American Varieties

'Manet' is one of the largest and mo attractive of the native plum types. Tl quality is good and the fruits are r in color. The tree is productive, ve hardy and comparatively free of pest

'South Dakota' is another good Ame ican type plum. Valuable as a pollenize for other American and American-Ja anese hybrid plums. Productive, hard with medum-sized, good quality fruits.

Persimmons

A most delicious and easily grow fruit not fully appreciated by hon gardeners. Annually productive ar nearly always exempt from serio pests so that spraying is not necessar In areas north of the southern thi of Illinois where native persimmon tre are not common, it will be neeessary have a male flowered variety such 'William' for pollination.

'Garretson' is one of the best ear varieties. Similar to 'Early Golden' b slightly smaller, earlier and better qua ity. Very good for short season area

'Early Golden'—an early, productiv good quality variety. Fruit is mediu large, orange-yellow in color.

'Killen' is slightly later than 'Ear Golden', productive of slightly larg fruits of orange-yellow color and goo quality.

'Craggs'—large, light yellow with so er flesh than the preceding varieti Quite rich and distinctive in qualit Maturity is slightly later than 'Kille

PRAIRIE HOME FRUIT GROWING

C. R. Ure

GROWING fruits in home gardens of the plains region of the northern United States and Prairie Provinces of Canada has definite limitations. These same limitations have challenged plant breeders to bring forth varieties of sufficient hardiness and adaptability for the area. They have been a challenge also to the home owner in his efforts to produce fruits for his own use. Most growers take immense pride, and justifiably so, in producing fruits that are considered beyond their natural range, and difficult to grow. As a result of success by both parties, a moderate volume of fruit is produced in many parts of the Great Plains region.

The successful culture of fruits in this great prairie area depends upon careful attention to a number of factors, some of which are peculiar to the region. Choice of adapted kinds and varieties of fruits, proper rootstocks, selection of a proper site for the orchard, provision for shelter from prevailing winds, pruning and training of the plants, and cultural procedures essential to the prairie environment are a few of those considerations. As pruning, soils and fertilizers will be dealt with specifically elsewhere in this publication, these subjects will be discussed only insofar as they may be peculiar to prairie requirements.

Kinds and Varieties of Fruits

In a discussion of the kinds and varieties of fruits that can be grown in the Great Plains region, comments and recommendations must be general in nature because of the vast extent of the area with its diverse local environments. Kinds and varieties adapted to one section may not be suited to another section. For specific recommendations a grower should contact his nearest Experimental Station, Department of Horticulture at a University, Extension Service or Department of Agriculture, or a successful grower in his immediate vicinity.

Only the hardiest kinds and varieties are likely to succeed. It is well to realize that most tree fruit varieties developed in more favored areas of this continent are not hardy enough for the plains region. Much time and effort have been lost through numerous attempts to grow varieties imported from commercial areas to the east, west or south. The most dependable varieties are those which have originated within the area, and more specifically within the local environment.

Results of experiments and trials have failed to produce any varieties of peach, sweet cherry, quince, or blackberry which are adapted to the prairies. Plant breeders have been unable to find a source of germ plasm possessing sufficient hardiness. The situation is more favorable in other fruits, however. There are varieties of pear, apricot, sour cherries, and grape which can be grown fairly successfully in many sections. Apple, crab apple, plum, plum hybrids, sandcherry or Bessey cherry-plum, currant, gooseberry, raspberry, strawberry and several native fruits can be grown with varying degrees of success over most of the area. Among the latter group, great success has been achieved in developing varieties with a high degree of hardiness accompanied by good appearance and fair to good quality. The range and choice of adapted varieties is expanding rapidly, and still greater advances are only a few years away.

Apple. Among tree fruits for this region, probably the greatest improvement

(Contribution No. 12 from Experimental Farm, Research Branch, Canada Agriculture, Morden, Man.)

has been made in the apple and its various forms. This universally accepted fruit should constitute a considerable portion of the prairie home fruit garden. Three types are successfuly grown. They are the large or standard apple, the crab apple, and an intermediate form, often referred to as the applecrab. The applecrab produces a fruit of large crab apple size but possesses the texture and flavor of the large, dessert apple. This type has arisen from hybrid progenies of large apple crossed with hardy crab apple designed to introduce greater hardiness into the large-fruited apple. Greater hardiness has been achieved in this way and has enabled dessert quality fruits to be grown where large apples fail. Some of the applecrabs are truly delightful to eat out of hand.

Space will only permit mention of a few varieties worthy of trial. In standard apple, 'Battleford,' 'Dr. Bill,' 'Haralson,' and 'Heyer 12' are best adapted to the northern sections. 'Heyer 12' is considered the hardiest apple of commercial size presently grown on the Canadian prairies. Through the central portion of the Great Plains, 'Breakey,' 'Goodland,' 'Godfrey,' 'Haralson,' 'Horace,' 'Patten Greening,' ' Goodhue,' 'Erickson,' and such Russian apple varieties as 'Moscow Pear,' 'Duchess,' 'Charlamoff,' 'Yellow Transparent,' and 'Hibernal' are successfully grown. Further south, 'Beacon,' 'Mantet,' 'Melba,' 'Oriole,' and 'Wealthy' may be safely added. Among the applecrabs 'Rescue,' 'Kerr,' and 'Renown' are the hardiest. Slightly less hardy but deserving a place in the garden are 'Trail,' 'Chestnut,' and 'Rosilda,' and for trial 'Northland' and 'Centennial' from the University of Minnesota. Crab apples are the hardiest form of *Malus* (apple) grown and provide a wide choice of varieties for jellies and preserves. 'Osman,' 'Columbia,' 'Garnet,' and 'Robin' are the hardiest cultivars grown at present, while 'Dolgo' is widely recommended except in the extreme north. It is supreme as a jelly crab, but tends to be too small and difficult to harvest for commercial use. 'Kerr' is rated high for jelly purpose Many others are obtainable.

Plums. Numerous types of plums a available to the home orchardist. First, l way of caution it should be noted th the European plum, *Prunus domestic* carries insufficient hardiness except in t southern portion of the region. Three n tive species, Canada plum (*Prunus gra*), American plum (*P. americana* and Bessey cherry-plum or sand cher (*P. besseyi*) are hardy and adapted the area generally. Superior selections these species, and hybrids between the and the Japanese (*P. salicina*) types, a the appricot plum (*P. simoni*) provi a wide variety of plums for the prai fruit orchard.

Cultivars of the native plum, and hybrids which lean strongly to the nati parents, are considered the most wide adapted to the prairies. They posse abundant hardiness, earliness and p ductivity. In this group one would l such varieties as 'Assiniboine,' 'Bount 'Dandy,' 'Norther,' 'Chilcott,' 'Man and 'South Dakota.' Another very har plum type, that appears equally as w adapted to the plains as the native plu is a group considered by some as simp a hardy strain of *Prunus salicina,* and others as belonging to the species *Prun triflora koreana* and *Prunus ussuriens* Such cultivars as 'Mandarin,' 'Ivanovk 'Ptisin Nos. 5, 9 and 10' and 'P.I. 2005 are certainly worthy of trial in this lat class. Dependable hybrids between t Canada and Japanese plums are rep sented by 'Grenville,' 'Pembina,' 'Mi and 'Ojibwa.' A large number of cultiva have arisen from crosses of American Japanese plums. Among their numb 'Tecumseh,' 'Radisson,' 'Underwood,' ' Crescent,' 'Redglow,' 'Superior,' 'R wing' and 'Redcoat' are widely grow Hybrids between the American and ap cot plums provide a class of fragra firm-fleshed plums of which 'Kag 'Hanska,' 'Tokata' and 'Toka' are amo the hardiest and best. Finally, anotl hybrid group designated as sandcher plum hybrids are well adapted to t prairies, particularly the more northe

ortions. Having arisen from crosses of he sandcherry by large plums, they are ow ,bush-like in stature, and as a conequence better able to withstand the orthern environment than taller tree orms. In this class, 'Dura,' 'Manor,' Sapa,' 'Opata' and 'Compass' are favortes. Under very extreme conditions seected plants of the Bessey cherry-plum r sandcherry such as 'Brooks,' 'Mando' r 'Manmoor' are planted.

Cherry. A number of cherries deserve lanting on the prairies. Among the Morello type cherries the Mongolian or warf bush cherry (*Prunus fruticosa*) is he hardiest and most widely adapted. The 3- to 5-foot-high bushes are consistnt, heavy croppers. As grown at Morden, he species is diverse in fruit types, with elected plants being excellent for jelly nd pies. The availability of named varieies and selected seedlings is limited, due n part to a lack of satisfactory, hardy ootstock. Other sour cherries of the Morello type, species *Prunus cerasus*, daptated to the central and southern porions of the region include 'Northstar,' Meteor,' 'Moscow' and 'Wragg.' 'Montmorency' and 'Bessarabian' do fairly vell.

The Nanking or Manchu cherry (*Prunus tomentosa*) is the nearest substitute or a sweet cherry for the plains area. This ornamental bush produces red or reamy fruits rated highly as fresh fruit, nd for canning, juicing or jelly. Besides elected plants, two cultivars have been amed 'Drilea' and 'Orient.'

Apricot. Considerable progress has een made in the development of hardy pricot. The South Dakota Agricultural Experiment Station, the Minnesota Fruit Breeding Farm, the North Dakota Agricultural Experiment Station, the Northrn Great Plains Field Station at Manlan, the Provincial Horticultural Station t Brooks and Strathmore in Alberta, and he Canada Experimental Farm at Morlen have had a hand in this work and are ble to advise growers on varieties for heir respective districts. Suggested for rial are such varieties as 'Scout,' 'Sing,' Robust,' 'Ninguta' and 'M-604.'

Pear. Pears are not as dependable generally as are apples and plums. However, those wishing to try this fruit should confine their planting to the following: 'Tait-Dropmore,' 'Pioneer #3,' 'Golden Spice,' 'Tioma,' and 'Olia.' Less hardy are 'Bantam' and 'Parker.'

Small Fruits

The small fruits, including currant, gooseberry, raspberry and strawberry are in general the most widely dependable fruits for the prairies. All are native to the region. Currant and gooseberry in particular can be grown most anywhere.

Strawberry is immensely popular, although its culture is somewhat limited by drought conditions. Among the June-bearing varieties 'Dunlap,' 'Glenheart,' 'Premier,' 'Glenmore,' 'Arrowhead,' 'Sparkle' and 'Aroma' generally perform satisfactorily. 'Gem' ('Superfection,' 'Brilliant') has been the most widely planted everbearer. Others in this class worthy of trial are 'Sparta,' 'Red Rich,' and 'Evermore.'

Raspberry. 'Chief' and 'Latham' are standard red raspberries over most of the area. Others which find favor in particular sections are 'Boyne,' 'Madawaska,' 'Newburgh,' 'Viking,' 'Muskoka,' and in the far north, 'Honeyking.' Black raspberries are somewhat tender in the north, although such varieties as 'Honeywood' and 'Bristol' are grown with moderate success. 'Sodus' appears to be the best of the purples.

Gooseberry. 'Pixwell,' 'Abundance,' and 'Pembina Pride' have been very hardy and productive. 'Captivator' is a new, large-fruited variety of promise. 'Perry' and 'Kataga' are hardy and large-fruited, but tend to be low in production.

Currant. Among red currants, 'Stephens,' 'Red Lake,' 'Diploma,' 'Cascade,' and 'Prince Albert' are popular, dependable varieties. 'Climax,' 'Kerry,' and 'Magnus' are hardy, black currants, while 'Boskoop Giant' and 'Buddenborg' appear slightly less hardy but are superior in fruit size and quality. 'Willoughby' is a new black of promise, and reported to be mildew resistant. The clove or flower-

ing currants, such as the variety 'Crandall,' are used both as fruit and as ornamental plants.

Grape. Most standard varieties of grape lack sufficient hardiness for the northern plains area. They must be given special winter protection if they are to succeed. When provided with proper conditions of location, protection, and culture the hardiest sorts deserve a trial. 'Beta' and 'Blue Jay' are among the hardiest. At Morden in southern Manitoba, 'Fredonia,' 'Moore's Early,' 'Campbell Early,' 'Portland,' 'Van Buren,' and 'Lindley' have done fairly well.

Native Fruits

A number of native fruits are brought under cultivation from time to time, or fruit is harvested from plants growing in the wild state. The more popular of these include *Amelanchier* species, variously called serviceberry, Juneberry, saskatoon, and shadblow; the American cranberry bush, highbush cranberry or Pembina berry (*Viburnum trilobum*); chokecherry and pincherry, mainly *Prunus virginiana* and *Prunus pennsylvanica* species respectively; and the native buffalo-berry (*Shepherdia argentea*). In addition, there are fruits of the native species of the American and Canada plums, the Bessey cherry, red raspberry, strawberry, currant and gooseberry.

Proper Rootstocks

Successful culture of such tree fruits as apple, plum, pear, cherry and apricot in prairie orchards depends in a large measure on having the trees grafted on a hardy, compatible rootstock. Most rootstocks used in commercial areas are too tender for the prairie winter, and it has been necessary to develop stocks adapted to the region. The grower is cautioned to make certain that the trees he procures are on hardy roots. Usually planting stock obtained from nurseries within the area is a combination of a hardy rootstock and an adapted top variety suited to the prairie environment. Experience has taught, for example, that apple trees worked on 'French Crab,' or the 'Ea Malling' (E. M.)vegetative stocks seldo last long. At present there is a heavy d mand for dwarf trees, but unfortunatel dwarfing stocks presently available do n possess sufficient hardiness for this ar generally.

Selection of a Site

Careful selection of a site for the hon orchard is of the utmost importance. Th selection involves such considerations convenience to ensure proper care of t orchard, topography of the land, s type, protection from prevailing wind water and air drainage, possibilities f irrigation and proximity to large bodi of water. A number of these factors a interdependent on one another.

If at all possible, the orchard shou be close to the buildings or home site. facilitates better care of the plants, eas harvesting, and generally adds to the a tractiveness and interest of the home are A location near the home enables fr quent observations, so that insect or di ease attacks can be controlled in the ear stages, damage by rodents and deer c be avoided, raiding by children can checked, and many cultural operatio including harvesting, can be done in spa moments. Protection of fruit trees fro rodents, particularly mice and rabbits, essential. This is easily accomplish when the orchard is within the farmste area, especially when the latter is fence When the larger farmstead area is pr tected by shelter belts or native trees, also provides much needed protection f the fruit. However, these advantages m have to be overlooked if proper soil, e posure, and protection cannot be provi ed within or adjacent to the building ar Rather than plant on poor, erode gravelly, or alkaline soil, on a steep slo on top of an exposed hill or in a hollo or depression where water or cold a may gather, it would be better to mo the proposed orchard to a more suitab site.

Proper exposure is exceedingly impo tant. Nature itself provides a very pr cise demonstration to guide the orchard

his choice of site. In the Great Plains nd adjoining parkland areas, wild fruits re seldom found on south or west exosures, except where protected by larger ees. Instead, wild fruits are more likely o be found on east, north or northeast xposures, protected from prevailing inds by trees or features of topography uch as hills or coulees. On south and est slopes, growth begins earlier in the pring, is frequently injured by late pring frosts, plants are more subject to unseald injury, evaporation is greater, nd the soil dries out more quickly.

Relatively level land is considered deirable for the Plains fruit garden beause of the need for clean cultivation. A gentle slope to the east or north is recommended. Steep slopes should be avoided as cultural operations are more difficult, valuable moisture is lost by run-off during heavy rains and such slopes are ubject to erosion. If possible, choose a pot that permits utilizing run-off waters rom higher ground for irrigation. This nay be accomplished through natural eservoirs or water impounded by small lams or dugouts. A site where cold air an drain away to lower levels is highly lesirable.

Protection from wind is a prerequisite o a successful fruit garden on the praies. This protection may be in the form of natural hills or mountain ranges, native rees, or, very often, trees planted for helter belt purposes. In the open plains at least, shelter belt trees should be 6 feet or more tall before the fruits are planted, n order to provide adequate protection. Shelter is usually a matter of necessity on north, west, and south to lessen the effect of hot, drying south winds of summer and the cold, desiccating winter winds from the north and west. Proper helter also reduces damage to the foliage nd breakage of the trees laden with fruit, lessens the amount of fruit blown rom the trees, favors better pollination hrough reduced air movement and a consequent greater activity of bees and other pollinating insects, furnishes a home for nsect-destroying birds, and aids in collecting and holding a uniform snow cover. Besides giving better root protection, the extra snow provides additional moisture.

Establishing the Orchard

On the prairies the accepted practice with tree fruits is to use well-grown, one-year-old whips for transplanting. These are often received from the nurseryman in the fall and are heeled in ready for early spring planting. Spring is the customary time to set out all fruit plants, with April being the most favorable month. Some fall planting is done, but losses tend to be high due to desiccation and winter injury. Spring planted trees are dormant or nearly so when planted, the soil is moist and cool, and temperatures are moderate. With a full growing season ahead, a high percentage of the newly set plants become well established the first year, before they are subjected to a rigorous prairie winter.

After the tree is firmly set in its permanent location, it is customary to shorten the stem to 20 to 24 inches. Besides compensating for the loss of root system during the transplanting, this forces the tree to produce branches lower on the trunk. Experience in the Northern Plains area indicates that a low-headed tree has a greater chance of surviving and being productive. The shorter tree is buffeted less by wind, under adverse conditions the lower branches often bear fruit while the upper portion is barren, and sunscald is much less severe on a low-headed, branchy tree than on one with a long exposed trunk.

Pruning of apple in the northern Great Plains region is directed towards developing a semi-bush type of tree. The typical tree is trained to a modified leader system, with five to eight main scaffold branches scattered uniformly around the trunk, preferably with the lowest branch arising from the southwest side of the main trunk at 10 to 12 inches above the ground level. Selection of scaffolds attached at wide angles to the trunk is especially important in order to avoid crotch injury which is likely to occur during our short growing seasons. Removal of side branches and general thin-

ning of the upper part of the tree is less severe than in commercial areas because of greater light penetration into trees in the plains area. Many hours of sunshine, lower humidity and high altitudes all contribute to an abundance of light reaching well into the center of the tree. Heavy pruning is not recommended, except to stimulate older, unthrifty, and unproductive trees. It tends to over-stimulate the tree in our short growing season and causes considerable succulent growth that fails to mature properly and may be injured by low temperatures. The details of how to prune and pruning systems will be found elsewhere in this publica- much like apple under prairie conditions. tion. (See p. 56.) The pear is tended

Plums are also trained to the modified leader system. Many of the plum types grown in the Plains area tend to be structurally weak in the crotch. The major pruning objective is to promote wider, stronger crotches. This is frequently accomplished by a very light removal of side branches for the first two or three years after transplanting. An excess of side branches is left as they tend to force one another outward, forming a wider crotch angle. About the third year, four to eight well-placed, strongly-crotched, scaffold branches are selected and the tree is built on this base. Apricot and sour cherry are handled in a similar way.

The training and pruning of the so-called sandcherry, which is really a plum and not a cherry, and many of the sandcherry-plum hybrids differs from that described previously. The plants are more bush-like in habit and bear most of their best fruits on one-year shoots. Because of this behavior they are pruned much like currants or gooseberries. As soon as older branches become unproductive they are cut off near the crown to encourage strong, new, whip-like growth. A gradual renewal of young fruiting wood by continuously cutting back 2- and 3-year branches is followed.

Cultural Practices

Brief mention is made of certain cultural practices deemed essential in prairie orchards. Annual rainfall is often far low the amount considered desirable r best fruit growth. In most parts of e area as much water as possible must e made available for tree growth. To acco- plish this objective, clean cultivation s practiced except where irrigation is p- sible. Attempts at permanent or part l sod have proved detrimental to fruit t e growth.

Continuous clean cultivation create a number of problems for the prairie - chardist. Among the more serious is a rapid decline in desirable soil structure a loss of organic matter and its associa l benefits, soil compaction on the heav r soils, creation of erosion problems, a l frequently a heavy loss of vital wa r through run-off during sudden hea y rainfall. Cultivation, if not stopped y mid-July or August 1, encourages c- tinued late growth so that the wood fa s to harden properly before heavy f l frosts occur. Some of these problems e partially corrected by frequent incorpo- tion of organic matter into the s l. Manure and various crop residues can e used for this purpose. In the occasio l wet season advantage can be taken o a green manure crop of one of the cere s or clovers sown about July 1 to 15.

Heavy loss of fruit plants is often p- vented when irrigation can be provid l. Ability to provide needed water to be- ing trees in a dry season, and a thorou h wetting of the soil in the root zone e last thing before freeze-up in the fall g s a long way to ensure survival. Matu e, fruiting trees over-wintering in dry s il are subjected to severe desiccation fr m cold, drying winds. Good shelter b s also do much to lessen the drying of - posed plant tissues.

Although most prairie orchards e placed on fertile soil, so that the ap i- cation of commercial fertilizers is seld m a major factor in obtaining desirable t e growth, there are circumstances when n application of chemical fertilizer is be- ficial. In a cool, backward spring, gro h tends to be slow, and the foliage a li t green color due to a temporarily low s p-

ly of available nitrogen in the cold soil. moderate application of a high nitroen fertilizer such as ammonium sulphate r ammonium phosphate generally enourages better growth. Also, when oranic matter high in fiber, such as wheat raw, is incorporated into the soil an pplication of ammonium phosphate 11-48-0 or 16-20-0) alleviates a tempoary nitrogen deficiency likely to occur uring decomposition of the plant resiue. In either case the rate of applicaon will vary from one to ten pounds per ee depending on tree size.

Growers wishing further information are referred to two helpful publications: "The Home Fruit Garden on the Northern Great Plains," Farmers Bulletin 1522, of the United States Department of Agriculture; and "The Prairie Home Orchard," Publication 901, Canada Department of Agriculture. The former is obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. for 20 cents. The latter is for sale by the Queen's Printer, Ottawa, Ontario, at a cost of 25 cents.

HOME FRUIT GARDENING N THE WEST

Reid M. Brooks

THE Pacific Coast States, and California in particular, are a mecca for ome fruit growers. Mild climatic conitions mean that a great variety of fruits nd nuts may be grown to perfection. ome 50 such crops are found in the Vest, old stand-bys such as apples, pears, eaches, grapes and plums, to such exotic ems as dates, filberts, guavas, olives, nd tangelos.

Thus some variety of most of our deiduous fruit trees can be grown almost nywhere in the West except in the high ountains where winters are severe. Most vergreens, such as citrus, may require pecial climatic conditions.

Fruits are available which require little r no care; others demand more than verage care to yield good, healthy crops. n the first group are such fruits as blueerry, carissa, feijoa, fig, jujube, olive, ecan, persimmon, pistachio, pomegrante, and quince. These can be left alone but improved quality and production will result from greater care.

Some fruits demand an annual pruning and spraying schedule. Among these are apple, blackberry, cherimoya, currant, date, fig ('Calimyrna' variety), gooseberry, grape, nectarine, peach, pear, raspberry, and strawberry.

Other fruits require average care, consisting of some pruning and spraying. Among these are almond, apricot, avocado, cherry, crab apple, filbert, grapefruit, guava, kumquat, lemon, mandarin, orange, passion fruit, plum, tangelo, English walnut, and white sapote.

Even the smallest garden has room for some fruit plants—a bush or a vine if it will not accommodate a tree. Several kinds of dwarf trees are now available which will produce ample fruit for a family. By topworking, you may have more than one variety of a single kind of fruit on one tree, such as an early- and a late-ripening apple; or have peaches, nectarines, and almonds; or oranges and lemons.

Several conditions and cultural practices prevail in the West with which east-

Source of material: "Western Fruit Gardening" by Brooks and Hesse. University f California Press, 1953.

ern gardeners are not usually concerned to so great a degree. Apart from winter hardiness and winter injury to plants, an important climatic factor in growing deciduous fruit trees in the West is their need for winter chilling. Lack of sufficient chilling results in irregular growth of buds; new foliage may not develop until some weeks after the normal time; flowering is irregular and long. Together these are known as *delayed foliation,* a condition especially prevalent in southern California. Lack of sufficient winter chilling may cause dropping of the fruit buds of apricot and peach just before flowering time. To correct this, plant a variety which has a low chilling requirement.

Frost damage is important in the spring, but it also may occur in early fall at temperatures much higher than plants will withstand in midwinter. In spring frost damage more commonly occurs as trees start to grow. Flower buds become more susceptible to frost damage as they open, and young fruits are more susceptible than flowers in full bloom.

Evergreen trees also suffer from frost damage, often in midwinter in areas where they are widely grown. Extensive damage is called winter injury.

However, the gardener may not mind losing an occasional crop to frost for the pleasure of growing a species somewhat outside its recommended zone. To do so, protected sites may be used. Espaliered, dwarf, or tubbed plants may be effectively protected by covering them.

Irrigation must be used in the West because rains are so seasonal, particularly in California where it might not rain from May to December. As a general rule, if the winter rains have not wet the soil to a depth of about 6 feet, or to the full depth of shallower soils (at least as far down as the roots are growing) the deficiency should be made up by an early spring irrigation.

Young trees must be adequately watered the first season after planting. Frequent light irrigations are needed rather than a lot of water applied at long intervals. In dry areas, trees should not be planted unless they can be watered at least three times a year: first in Ma or April, if there has been deficient ra fall, or in June, if rainfall has been n mal, and then at monthly intervals, p erably until October. Soil moisture m be maintained at all times; otherw fruit will be small and of poor quality

To insure getting the varieties of y choice, order plants from your nurs man as early in autumn as possible. Washington and Oregon fall planting is often recommended and nursery pla are usually available then. In Califor and Arizona deciduous trees are m likely to be planted in January February.

Some Western Fruits

Almonds do best in California's Joaquin and Sacramento Valleys, similar areas where warm, dry summ allow the nuts to ripen. Almonds blo very early (February).

Varieties range from paper-shell ('Nonpareil'), through soft-shell ('Jordano,' 'IXL,' 'Ne Plus Ultra,' 'Eureka') to se hard-shelled nuts ('Texas'). All varie are unfruitful to their own pollen, thus pollen from another variety must used to produce fruit, so plant trees two varieties, or graft one variety ont a tree of a different variety.

Apples are the most widely adapted all the temperate zone deciduous fru Varieties are available which do well almost all the climatic regions of Western states — except the low des areas of California and Arizona. Id growing conditions are found in east Washington, western Washington Oregon, the coastal districts of centr and northern California, and some mo tain valleys in central California.

The apple has a high chilling requirement but some varieties are availa which need little winter chilling ('Bev ly Hills,' 'Delicious,' 'White Pearma 'Winter Banana') and thus are suita for southern California. Otherwise, choice of a variety for your own gar is largely a matter of personal pref ence.

Semidwarf and dwarf trees may propagated by using rootstocks known

Malling IX,' 'Paradise,' 'Malling VII,' Malling V.' etc. (See article on p. 64.)

Apricots can be grown throughout the West except at high altitudes or in areas where late spring frosts destroy flowers or young fruits, as trees bloom very early (but after almonds). Best areas are the coastal valleys of central California near San Francisco Bay, and eastern Washington. The apricot's chilling requirement is very similar to the peach's.

'Royal' or 'Blenheim,' 'Tilton,' 'Wenatchee,' and 'Moorpark' are the main varieties but newer ones such as 'Riland,' 'Phelps,' 'Perfection,' and 'Reeves,' may be tried.

Seedlings of the Western sand cherry (*Prunus besseyi*) used as rootstock produce semidwarf apricot trees.

Avocados grow best in areas where the temperature does not fall much below freezing, thus limiting their culture almost entirely to southern California and a few areas in Arizona. Varietal quality is based on per cent oil content—the higher, the better the variety—and not on appearance, shape, or color.

Blackberries include trailing blackberries and dewberries, and the upright or bush forms. They do best in regions with cool, fairly humid summer climates. Most varieties are susceptible to winter injury, and in areas where summer day temperatures are very high the vines do poorly.

Familiar good varieties are 'Boysen,' a favorite because of superior quality and high yields. 'Logan' and 'Thornless Logan' are more tart than others and so are good for baking and processing. 'Young' and 'Thornless Young' are like 'Boysen' but do not produce as well. 'Evergreen' and 'Olympic' do best only in western Washington and Oregon as do the upright varieties 'Eldorado,' 'Mereau,' and 'Snyder.'

Blueberry culture is limited by soil and climate, requiring a cool summer for best development, and succeeding best in western Washington. Blueberries are adapted to many acid soil types. They are reasonably free of disease and pest troubles, have a fine growing habit, and make good ornamentals as well as supplying the gardener with satisfying fruit. The newer varieties, *e.g.*, 'Atlantic,' 'Dixi,' 'Pemberton,' and 'Stanley,' are superior to the old ones.

Carrissa or **Natal plum** is a medium-sized, evergreen shrub from South Africa, with white flowers which produce red fruits. Grow in temperatures above 26° F. Plants are very free from diseases and insects.

Cherimoya bears a custard-like fruit which is grown in mild subtropical regions, but does not do well where the summers are hot or the winters frosty. Individual fruits may average 1½ pounds each. Diseases and pests are not yet found on cherimoya in California.

Cherries—sweet, sour, Duke, flowering—all do well in the West. Sweets like an intermediate climate, as found in the valleys of eastern Washington, the river valleys of Oregon, in areas around San Francisco Bay in California, and in foothill areas (up to 3,000 feet) of the hot interior valleys of California. They are not as hardy as most other stone fruits.

Sweet cherries have red to dark purple flesh, as found in 'Black Tartarian,' 'Bing,' 'Lambert,' 'Van,' or cream-colored flesh as in 'Napoleon' ('Royal Ann'). Sweets are self-unfruitful, thus require cross-pollination; moreover, 'Bing,' 'Napoleon,' and 'Lambert' are inter-unfruitful and therefore with these some other variety must be planted (*e.g.*, 'Black Tartarian,' 'Van'). Since sweet cherry trees grow to be very large, 'Stockton Morello,' a variety of sour cherry, may be used as rootstock to produce a semidwarf tree.

Sour, pie, or red cherries form an ideal garden tree, being easy to grow and not as large as true sweet cherry. They will withstand a more rigorous climate than sweets. Good varieties are 'Montmorency' and 'Early Richmond.' Duke cherries are hybrids between sweets and sours, with the color and shape of sweets and the tartness of the sour.

Cherries are susceptible to many diseases and pests. Perhaps the most serious trouble is bacterial canker, for which there is still no adequate control. Brown rot of flowers and fruits proves trouble-

some in humid areas, but may be controlled by sprays or dusts. The cherry fruit fly occurs in the Northwest. Viruses may be present in any cherry, so be sure to start with healthy plants.

Chestnuts make wonderful shade trees, and the nuts are good. They do well in cool climates, especially in the Northwest and in the California foothills up to 3,500 feet. They are winter hardy. Two kinds are available, Chinese and European varieties.

Crab apples are eaten fresh or made into pickles or jelly. A rule of thumb makes all apples with fruits 2 inches or less in diameter crab apples. Their climatic range exceeds that of standard apple varieties. Fruit colors vary from pure yellow to pure red. The trees are usually small, up to 20 feet.

Currants are easily grown, extremely hardy, and do best in a cool, humid climate such as that of western Oregon and Washington and along California's central and north coasts. Good varieties are 'Cherry,' 'Fay,' 'Red Lake,' and 'Perfection.' In pruning, do not save canes four years old or older as they are less fruitful; the best fruit comes from two-year-old canes.

Dates have been cultivated for thousands of years. The fruit clusters arise at a greater height from the ground each succeeding year, finally reaching a height of 75 feet or more. Good-quality fruit requires long, hot summers as found in Arizona and California in low desert valleys. However, they will grow in milder climates, but produce inferior fruit.

Feijoa fruits have a somewhat tart flavor, suggestive of pineapples. The shrubs will grow to 15 feet or more but may be kept easily at 10 feet or less by pruning. Fine marmalades, jams, and jellies may be made from the fruits, or they may be eaten fresh by first removing the outer skin. The inch-wide flowers produce purplish white, fleshy petals which are good in salads. A subtropical fruit, it prefers cooler climates, doing well in northern California.

Figs are produced twice a year, in early summer and again in the fall. Trees will grow to tremendous proportions—90 feet spread—if allowed to do so; c they may be kept small—5 feet—by jud cious pruning. Cultural requirements a few.

The 'Mission' variety is excellent, ev though black-skinned; it is suitable fres dried, and for jams. 'Calimyrna's' secon crop yields large, lemon-yellow frui with amber pulp. 'Kadota' is most canned or dried, 'Turkey' is used fres while 'Adriatic' is usually dried. 'Cal myrna' requires cross-pollination with th caprifig (male), a procedure called capr fication; it is accomplished by the pre ence of a wasp. The other varieties nee no pollination to produce fruit.

Figs are propagated by cuttings. Fe insects and diseases attack the trees.

Filberts, sometimes called hazelnut grow and bear well in western Orego and Washington, but do not bear well i California. The two important varieti are 'Barcelona' and 'Du Chilly,' and the need cross-pollination. Except for filbe blight in the Northwest, filbert trouble are minor.

Gooseberry pies, jelly, preserves, an marmalades are excellent because th fruit is tart and pleasing, rich in aci and pectin. 'Oregon Champion' is recom mended. No gooseberry is well adapte to California.

Grapes are grown by the gardener fo table use, for their sweet, unfermente juice, and sometimes for canning an drying. Winemaking is not discusse here. In the Northwest or a coastal area choose the earliest-ripening Europea varieties so they will mature before ad verse weather arrives in the fall. Mos European table grapes can be grown i the hotter interior valleys. America grape varieties do best in a more humi area, and approach their highest qualit in the Northwest. In California, th coastal valleys are best for these.

The common table grapes grown i California are the European species, pro ducing many varieties suitable for eatin fresh, for canning, and for making grap juice. Native American species and thei hybrids with Europeans are called slip

kin grapes because the skin slips easily rom the pulp. American varieties are nore common in the Northwest where hey are used for grape juice, although hey are liked fresh because of their foxy lavor.

'Pearl of Csaba' has a muscat flavor, is nearly seedless, and does well in the Northwest. 'Delight' is the first truly muscat-flavored seedless grape developed. Thompson Seedless' is the most popular grape for eating fresh because it is seedless and sweet. 'Ribier' is a beautiful black table grape. 'Searlet' is black, with bright-red, sweet juice, having a mild Concord'-type flavor, and is recommended for an arbor. Other varieties suitable for the home garden are 'Monukka,' 'Red Malaga,' 'Flame Tokay,' 'Muscat of Alexandria,' and 'Muscat Hamburg.'

American and hybrid varieties are adapted to cooler regions than European grapes, and can withstand more humid climates. In approximate order of ripening from late July through October are 'Early Giant,' 'Portland,' 'Campbell's Early' (for the Northwest), 'Fredonia,' 'Worden,' 'Niagara,' 'Seneca,' 'Concord,' 'Delaware,' and 'Keuka.'

Grapefruit does best in the desert regions, especially of Arizona; in California it does well in the warmer inland areas of the south coast. Temperature influences the flavor during the growing season far more than it does that of orange. 'Marsh' is a fine, large, juicy, highly flavored, usually seedless variety. 'Ruby' is seedless with red flesh. For other remarks, please see Orange.

Guavas, Cattley or strawberry guava and common or lemon guava, have a high vitamin C content and make a musky but pleasant jelly. They are also eaten fresh. The large evergreen bushes may reach 20 feet if not pruned much. Cattleys do well wherever lemons are grown, while the common guava is more tender and likes protected places. They are remarkably free of insect pests and diseases.

Jujubes, sometimes called Chinese dates, have mild, quite sweetish, crisp flesh, but they are usually candied or glacéed, dried or canned. The trees are

Kumquats are among the hardiest of the citrus fruits

well adapted to California's hot valleys and any desert region. They are highly ornamental, with small, shiny green leaves and zig-zag twigs. The fairly winter-hardy trees appear to be free of all pests and diseases.

Kumquats, spicy, small citrus fruit, mildly acid, can be eaten in entirety, both rind and flesh. The trees are among the hardiest of citrus, doing well in California and Arizona (except in the mountains), and with proper protection in much of the Pacific Northwest. They grow only to about 10 feet. On trifoliate orange rootstock a dwarf tree, 2 to 4 feet tall, is produced and thus may even be grown in large pots or tubs.

Lemons are less tolerant of cold than orange. Trees of some varieties, *e.g.*, 'Meyer,' are small and the fruit is a little less acid than true lemons such as 'Eureka' or 'Lisbon,' which grow on large trees.

Limes, a highly flavored acid fruit, are very cold-tender, so should not be attempted where temperatures fall below 28°F. Some lime-like fruits, such as Rangpur, are good substitutes as they withstand lower temperatures. Limequats and calomondin are good, too, and less sensitive to cold than are limes.

Loquats are long-lived evergreens, producing yellow egg-shaped fruits in the springtime. The tree is usually about 20 feet tall but may be double that height. Leaves are long, up to one foot, and 3 inches wide. Loquats can be grown almost anywhere in California. Because blooms appear in the winter, it is not suitable to high elevations or the Northwest.

Macadamias produce a fine nut, high in oil but encased in an extremely hard shell. A native of Australia, it is relatively new to the Pacific Coast. Being cold-sensitive, plantings should be limited to nearly frost-free areas, as lemons are. The tree is slow-growing and reaches a height of about 30 feet.

Mandarins are loose-skinned oranges, sometimes called tangerines. Trees are very cold-resistant but the fruits are as sensitive as sweet oranges. Good quality fruits require a warmer summer than oranges. 'Dancy' (Dancy tangerine) is the best known mandarin. 'Owari' ('Owari Satsuma') is not as sweet as 'Dancy' but is recommended for northern California. Newer varieties are 'Kara,' 'Kinnow,' and 'Frua.'

Nectarines are smooth-skinned peaches. Trees are identical to peach trees but the fruits are usually smaller, sweeter, and with a distinct aroma. There are clingstone and freestone, yellow- and white-fleshed nectarines. Nectarine seeds may produce peaches and vice versa. Most of the old standard varieties are clingstones with white flesh, but most of the many newer ones are freestones with yellow flesh. Varieties may be selected which ripen during the period from the last week of June through the first of September. Among these are 'John Rivers,' 'Cardinal,' 'Early Flame,' 'Dixie,' 'Silver Lode,' 'Mabel,' 'Philp,' 'Flaming Gold,' 'Pioneer,' 'Freedom,' 'Garden Stat 'Stanwick,' 'Tioga,' and 'Victoria.' Cu ture and climate are identical to tho of peach.

Olives are adapted to California's h interior valleys and deserts. This eve green has feathery, grayish foliage. It a graceful ornamental as well as an i portant pomological species. Fruits a used for pickles, never eaten fresh, a the higher the oil content, the better t fruit. Heating ripe processed olives b fore serving brings out the flavor.

Oranges are of three types: comm fruits ('Valencia' and 'Trovita' vari ties), navel fruits ('Washington,' 'Ro ertson'), and blood fruit ('Ruby,' 'Toro co'), having red pulp and juice. The ripen throughout the year: for exampl 'Valencia' in summer, 'Washington' winter, 'Ruby' in late winter or ear spring. Sweet oranges set the standa of comparison of cold resistance for ci rus. Mature, vigorous orange trees wi withstand temperatures down to abo 15°F., which sets their cultural limi Since oranges bloom for a long tim spring frosts are not too serious. A fruit is on the tree during winter, it more susceptible to frost damage tha flowers or branches.

Trifoliate orange seedlings are used a a rootstock to dwarf citrus varietie Citrus are sensitive to wet soils yet nee frequent waterings. Thus the soil shoul drain rapidly. Trees require nitrogen bu no other fertilizer. However, some Cal fornia soils lack sufficient potassium an if symptoms of deficiency are present— weak growth, small fruit, puckered an lusterless leaves—apply large amoun (10 to 15 pounds per tree) of potassiu sulfate.

Not much pruning is required. A trees grow older, cut out crossing an interfering limbs. Trees tend to shap themselves. There are many pests an diseases, usually minor, quite a few phys iological disorders, and a few viruses.

Papaya fruits may be ripe eight month after the flowers bloom, and flower bloom five months after planting seed The fruits are large, up to 5 pounds, hav

g a succulent thick flesh. Since this is tropical species, it may be grown only the warmest frost-free areas, or in a eenhouse.

Passion Fruits are woody, evergreen, ermial vines which grow very rapidly; ey are considered subtropical. The ost familiar edible passion fruit is a rple one, sometimes called the purple anadilla. Fruits are about the size and ape of an egg, bearing many small eds surrounded by juicy pulp—aro-atic, of a different, pleasing, acid fla-or—encased by a thin, hard rind. The owers are exotic looking. There are no rious pests or diseases.

Peach is queen of the temperate zone uits, being the most widely grown tree uit in the world, next to the apple. Its ange is a little south of apple as it is ss hardy than apple. Peaches grow ell in clear, hot weather and thus do est in the West's hotter inland areas. n California they reach perfection in he hot interior valleys, and up to 2,000 eet in the foothills.

Peach trees are very attractive in loom. They do not become very large, bout 15 feet with a spread of about 8 feet. They start bearing good crops hen 3 or 4 years old, reaching their eak at 8 to 12 years.

There are freestones and clingstones, nd yellow- and white-fleshed fruits. Most home gardeners prefer yellow free-tones. Varieties are legion, with new nes being introduced regularly. Here re some varieties (not for southern California) arranged by ripening dates, eginning the first week in June and end-ng the middle of October: 'Mayflower,' Merrill Gem,' 'Blazing Gold,' 'Starking Delicious,' 'Redhaven,' 'Golden Jubilee,' Veteran,' 'July Elberta,' 'Halehaven,' Babcock,' 'Elberta,' 'Fay Elberta,' 'J. H. Hale,' 'Alamar,' 'Rio Oso Gem,' 'Currie Free,' 'Salwey,' 'Merrill Late Gold,' Levy,' 'Miller's Late.'

Because of a low chilling requirement n southern California (see p. 84) other varieties are necessary there, *e.g.,* 'Robin,' Meadow Lark,' 'Ventura,' 'Redwing,' Merrill Gold Rush,' 'Babcock,' 'Flamingo,' 'Three Star,' 'Hermosa,' 'Golden Blush,' 'Rio Oso Gem,' 'Altair,' 'Sime,' 'Curlew' (end of September). These will also grow satisfactorily northward.

Peaches are self-fruitful except for 'J. H. Hale' and 'Alamar,' which have no pollen. Fruits may set too heavily and therefore must be thinned in order to produce those with good size and quality. Thin when the fruit is about 1¼ inches in largest diameter, leaving one fruit every 6 to 10 inches along the branch.

Pears bear good quality fruit from midsummer until late fall. The popular 'Bartlett' comes first followed by many excellent varieties. 'Seckel' ripens about a month after 'Bartlett' and is the variety *par excellence* for the garden, even though the fruit is small and somewhat unattractive. 'Dana Hovey,' 'Comice'—many consider this the best pear there is, 'Hardy,' 'Winter Nelis,' 'Bose,' and 'Winter Bartlett' are other good later-ripening varieties for the West.

'Bartlett,' 'Comice,' and 'Hardy' are usually self-fruitful in California, but not in the Northwest.

Dwarf trees may be produced by budding to quince rootstock and pears for espaliering or planting in boxes should be on quince.

Pears are susceptible to fire blight. Some resistant but inedible varieties are available, *e.g.,* 'Old Home' and 'Farmingdale.' Bud these to quince and allow them to produce main branches. At a distance of 18 to 24 inches from the trunk graft or bud the desired variety. If fire blight hits a branch, it will not destroy the entire tree. If planted deep, either 'Old Home' or 'Farmingdale' will usually produce its own roots; the quince will die, and therefore the entire trunk and roots will be resistant to fire blight.

Pears should be ripened off the tree, as tree-ripe fruit is inferior. Pick when green and hard, but of the size the given variety should be when ripe. Ripen in a cool place.

Pecans require long hot summers to fill the shell properly. They can be grown as shade trees in most areas, however, as

they are resistant to low winter temperatures. The trees are graceful but extremely large, thus are not too well suited for the small home garden. In order to secure a long growing season to mature the nuts, select early-leafing varieties such as 'Select,' 'Nellis,' and 'Humble.' Other varieties, 'Mahan,' 'Success,' and 'Burkett,' are fairly well adapted to California. Trees need little if any pruning.

Persimmons used in the West are the Oriental (Japanese or kaki) species, and they may be grown almost anywhere where temperatures do not go below 0°F. Their fruits are of two types, astringent and non-astringent. Astringent varieties ('Hachiya') pucker the mouth unless the fruit is extremely soft, when they have a rich flavor. Non-astringent varieties ('Fuyu') may be eaten firm ripe, like an apple, but their flavor is different from that of the Hachiyas. Persimmon is perhaps the best fruit for home planting if one wishes to give little or no care to the tree, yet have delicious fruit.

Pistachio nuts have a blush-pink shell surrounded by crisp flesh. To process, remove the covering, dip the hulled nuts in water, spread in the sun to dry and to split the shell; or, boil the nuts in a salt solution for a few minutes, then redry. The fairly large tree grows slowly, but can be kept small by pruning. It is as cold resistant as almond. Pistachios are dioecious, having male and female flowers on separate trees. In order to secure nuts, plant trees of both sexes, or graft scionwood of a male tree into a branch of the female variety.

Plums are many, so that one or more should fit anyone's taste. European, blue, or common, plums ripen during late summer and fall (*e.g.,* 'Tragedy,' 'Emilie,' 'Rayburn,' 'Italian,' 'President'). They do well in the Pacific Northwest and in California's central and northern coastal and interior valleys, and in mountains up to 2,000 feet.

Prunes are European plums which can be sun-dried without fermenting at the pit. (See Prune.)

Japanese or Oriental plums are usually red and bloom early ('Beauty,' 'Burmosa,' 'Santa Rosa,' 'Redheart,' 'Satsuma,' 'Duarte,' 'Red Rosa'). They do well in eastern Washington and Oregon valley sites but reach perfection in California foothill and valley areas, and also do well in southern California at higher elevations. They do best with hot summer days. They make great shoot growth and must be pruned rather severely at all ages. They tend to overbear, and if they do, they should be thinned by removing fruit from the tree as soon as they are easily seen, spacing the remaining ones 4 to 6 inches apart.

There are many American species of plum, native to the Southwest, the Pacific Coast mountains, and central Canada.

Damson plums are tart and are used for jams and jellies. They are more cold resistant than Europeans.

Many ornamental plums are suitable as well for jellies and jams, and some are edible fresh ('Thundercloud,' 'Pissardi' 'Hollywood').

Some varieties are inter-unfruitful; this means, *e.g.,* that 'Beauty' and 'Kelsey' or 'Beauty' and 'Burmosa' will not pollinate each other.

Plumcots are hybrids between apricots and plums, having characteristics of each. They do not bear well. Climatic requirements are like the apricot's.

Pomegranates produce red round fruit 3 to 5 inches in diameter, bearing numerous seeds surrounded by a soft tissue which contains a sweet but astringent juice, all encased in a leathery shell. Pomegranates make either a bush or a small (10 feet) sturdy tree by appropriate pruning. They will stand temperatures to 10° to 15°F. and do well in the hot valleys of California and in the desert regions. Pomegranates can be grown with no attention.

Prunes are European plums which can be dried without fermenting at the pit due to their very high sugar content. They may be eaten fresh but are very sweet. The most important commercial variety grown in California is 'French,' small and yellow-fleshed. 'Imperial' is very large; 'Sugar' is often sold fresh and may be canned. (See Plum.)

Quince fruits are fragrant, up to 5 inches in diameter, and are found on a small, twisted tree or shrub. It is well adapted to many regions, perhaps more so than any other fruit tree. 'Smyrna' is probably the best variety. Pests and diseases are not serious.

Raspberries do best in the Northwest, especially in the mountain valleys and western Washington and Oregon. The best areas in California are in cool valleys of the north coast, but no variety is really adapted to the hot summers of Arizona and California. Under best conditions they produce fruit all summer, but usually have peak seasons in spring and fall.

Of the three kinds of raspberries, red, black, and purple, only red varieties, such as 'Lloyd George,' 'Washington,' 'Latham,' Newburgh,' 'Taylor,' and 'Cuthbert,' do well in California. All kinds grow well in the Northwest. 'Bristol,' 'Munger,' and Plum Farmer' are among recommended black varieties for Oregon and Washington. 'Sodus' is the only purple raspberry recommended. It does well in eastern Washington and Oregon.

Strawberries can be grown nearly all over the West, but they require good care. They should never suffer from lack of water. Plant in soils with good drainage and with no high concentration of salts.

Recommended varieties for the Northwest are 'Marshall,' 'Howard 17' ('Premier'), 'Corvallis,' 'Brightmore,' 'Catskill,' 'Fairfax,' and 'Dorsett.'

The varieties listed above have been superseded in California by others because of greater climatic and soil adaptation and disease resistance. Some are 'Shasta,' 'Solana,' and 'Klondike.' Everbearing strawberries bloom and fruit during the entire growing season, but do not yield high crops at any one time. Among the everbearers are 'Rockhill' and 'Twentieth Century.'

Nearly all plants are propagated by runners, and will bear for 3 or 4 years, sometimes longer. They are planted either in raised beds which are irrigated by furrows between the beds, or in flat beds which must be sprinkler irrigated.

Tangelos are considered the best of all citrus fruits by some people. They are hybrids between mandarins and grapefruits. They are very tender, so cannot be shipped, and thus their main value is as a garden fruit. Some resemble oranges, others mandarins. Tangelos are similar to oranges in climatic requirements. 'Minneola,' 'Sampson,' and 'Pearl' are all good varieties, 'Minneola' being the best.

Walnuts are of two kinds: the more important species is the English or Persian walnut, with shells that are easy to crack and excellent meats used in many ways. The black walnuts, not discussed here, produce hard-shelled nuts and small meats with a pronounced flavor. English walnut trees are 50 to 70 feet tall with an equal spread, so usually they are not planted by home gardeners. Black walnuts are more upright but not as good looking, and are not well suited for the garden. The northern limit of English walnuts is the low valleys of western Oregon and Washington; elsewhere, danger from frost is too great. In California they are grown in nearly every county. In mild climates, delayed foliation is a problem (see page 84). Unless they are shaded nuts will sunburn in temperatures above 105°F., and these fail to fill properly.

The 'Franquette' Persian walnut is excellent and about the only one recommended for the Northwest as it flowers late and the tree is cold resistant. It will do fairly well in California, as do 'Eureka,' 'Hartley,' and 'Concord.' Suitable for southern California are 'Payne' and 'Placentia.'

Northern California black walnut seedlings are the usual rootstocks, being resistant to oak-root fungus.

White Sapotes produce small to medium evergreen trees, with large, five-fingered leaves. The soft-fleshed fruit is the size and shape of a small apple, with a distinctive flavor. They are grown in nearly frost-free areas and are free from diseases and pests. 'Coleman,' 'Wilson,' and 'Pike' are good varieties.

TROPICAL AND SUBTROPICAL FRUITS FOR HOME GARDENS

H. S. Wolfe

THE only truly tropical area — one that never experiences frost — in the United States is on the Florida Keys. Many typical fruits of the tropics are grown, however, in the southern part of the Florida peninsula, especially near the coast from Palm Beach and St. Petersburg southward. The area suited to subtropical fruits is much more extensive, reaching its northern limits along the Atlantic coast in Virginia and extending southward along the coastal plain to southern Texas, then leaping across to southern California and adjacent Arizona. Not all of this area is equally suited to all fruits. Some thrive only in the warmer half of this area, while others flourish in the cooler part.

General Culture

In general, all of these fruits require about the same sort of attention to fertilizing and pesticide application as do northern fruits, but they do not usually respond profitably to the intensive training and pruning given apples and peaches. Most of them are evergreen and make three flushes of growth each year. It is customary to apply fertilizer to bearing trees just ahead of each flush, usually in February, June and October in Florida. Young trees not yet in bearing are fertilized more frequently, about every 6 to 8 weeks, and papayas thrive best if fertilized biweekly.

Since Florida soils are usually very low in mineral nutrients, it is customary to use in home gardens a fertilizer mixture analyzing 6% N (nitrogen), 6% P_2O_5 (phosphorus pentoxide), 6% K_2O (potassium oxide) and 3% MgO (magnesium oxide). Such minor elements as zinc, manganese, and copper are frequently deficient in these soils, but are more rea ily available to trees from sprays th from soil applications.

Soil management practices in Flori call for growth of green manure cro during the summer months when rainfa is ample for both trees and cover cro and mowing or disking down the gre manure crop in the fall. Irrigation often beneficial during the winter spring months, when there may be period of several weeks with little rai but is not regularly practiced in co mercial orchards. Mulching is a very d sirable practice for home orchards tropical and subtropical fruits if a supp of organic mulch can be obtained reaso ably. However, when frost threaten mulch should be raked out from und trees. The sandy soils of Florida are n well buffered and tend easily to becon too acid from fertilizer or spray residu Use of dolomitic lime to maintain the p between 5.5 and 6.0 is an important ma agement practice. On the calcareous soi where avocados, limes and mangos a principally grown, control of pH is n possible. Heavy organic mulches ar minor sprays keep trees in good heal when used with ordinary fertilizing pra tices.

Citrus Fruits

Best known and most important co mercially among subtropical fruits a the **orange**, **grapefruit**, **lemon** and **ta gerine**. These are suited to the warm su tropics (and to the tropics also), and a chiefly cultivated in central and southe Florida, the Rio Grande Valley of Texa and southern California and Arizon Lemons are a little less hardy to cold tha are the other three, but while their co mercial production is largely limited

alifornia, they may be grown for home e in all the above areas of citrus cul- re.

Satsumas, kumquats, and **calamondins** e citrus fruits able to endure a few de- ees more of cold than oranges, and so e grown in northern Florida and south- n Alabama, Mississippi, and Louisiana. imes, on the other hand, are tropical uits and are grown extensively only in outhern Florida, with some culture in ie warmest parts of California and exas. The calamondin is essentially an nusually hardy lime, and is grown only or home use.

Culture. All citrus fruits, except the mons and limes, have a long period of me during which any individual fruit ay be harvested. Usually it is at least ree months from the time a given va- iety reaches good eating maturity until is definitely over-mature. Thus a few uits may be picked daily over several onths. The lemons and limes are picked nmature, but their repeated blooming akes their fruit constantly available. An em of unusual importance with all cit- us fruits is the stock employed. In gen- al the sour orange stock is satisfactory or most citrus fruits on soils of good oisture content, while 'Rough' lemon tock is more satisfactory for well rained sandy soils. There are several peeial cases of adaptation of scion to tock, however, which make neither of he above stocks satisfactory. Thus, the atsuma is satisfactory only on trifoliate- range (*Poncirus trifoliata*) as stock, while 'Temple' has much better quality on Cleopatra' than on 'Rough' lemon stock.

Varieties of orange are far fewer than hose of apple or peach, although com- nercial orange production far exceeds hat of the apple, and half a dozen varie- ies make up 95 per cent of production. Valencia' is the leading variety in all the range growing states (except for the mall Louisiana industry) and matures in pring and summer. 'Washington' navel s the other leading variety in California or fall and winter, while in Florida and Texas several varieties mature in sequence n this period. **Grapefruit varieties** have less variation in maturity, and are divided into seedless and seedy. 'Marsh' is the leading seedless variety, with several red- or pink-fleshed sports quite popular. 'Duncan' is the chief seedy variety and the standard of quality. The best known **tangerine**, is 'Dancy,' coming in for Christmas.

Often classed with oranges for convenience are some hybrids between orange and tangerine, the **tangors**. The so-called 'Temple' orange is one of these, and is considered as unsurpassed in flavor among oranges when well grown. Its season is late winter. Another interesting group of hybrids is the **tangelo**, the result of crossing tangerine and grapefruit. Some tangelos are like very juicy oranges while others are rather tart, but all are tasty. Among the best are the mid-winter maturing 'Minneola' and 'Seminole.'

The commercial **lemon varieties**, 'Eureka' and 'Lisbon,' are best for home use in California, while 'Meyer' is a strictly home garden lemon, grown in Florida, Texas, and California. It is orange in rind and flesh color. The chief **lime variety** of Florida is the 'Persian' ('Tahiti'), which is green and seedless, and this is also the lime of California (as 'Bearis'). Texas and the Florida Keys grow the seedy 'Key' or 'Mexican' lime.

Fig, Kaki, and Lychee

Typical fruits of the cool subtropics are the fig and the kaki, or Oriental persimmon, which do best north of the areas of satisfactory citrus culture. Both are deciduous in winter and mature their fruit in summer and fall. For the most part, no pollination is required for fruit setting in the varieties grown for home use. No systematic pruning is practiced in the home orchard. They are fertilized like other deciduous fruits.

Figs are troubled greatly by the root-knot nematode, especially on sandy soils, and must be heavily mulched in the garden to avoid attack. They are propagated only by cuttings. 'Celeste,' 'Brunswick,' and 'Brown Turkey' are leading varieties in the Southeast, while the latter two plus 'Kadota,' 'Adriatic,' and 'Mission'

Lychee fruits e
delicious fres
preserved, or dr

Courtesy University of orid

are all popular in California.

Oriental persimmons are about like apples in range of fruit size and are bright yellow-orange to orange-red in color. 'Tanenashi' is the chief variety in the Southeast, and 'Hachiya' in California; both are large and seedless and need no pollination. A few varieties needing pollination are sometimes grown. All kakis are free from astringency when soft and ripe, but most seedless ones pucker the mouth until they are fully ripe. 'Fuyu' is an unusual variety which is never astringent at any stage of maturity. Kakis are grafted on seedling stocks of several species: in Florida and Texas the native persimmon is used, while in California, seedlings of the kaki and of the Chinese lotus persimmon are preferred. In the South, kakis are usually rather short-lived.

The lychee is a fruit of the warm s tropics which has recently been plan commercially in central and south Florida. The fruits mature in June a look like large ripe strawberries; t have a brittle red shell around a glist ing white pulp of delicious flavor. T tree is propagated only by air layer but is easily grown. The dried fruits, sembling raisins in a thin shell, have l been imported from China as lyc "nuts."

Avocado

Avocados are derived from three w races with different climatic adaptatio The Mexican race endures as much c as the orange, the Guatemalan race about as hardy as the lemon, and t West Indian race is more like the lime cold tolerance. Florida grows varieties

Avocado fruits do not ripen until removed from the tree

ne latter two races and of crosses be-ween them, while California grows the rst two races and their hybrids. In Cali-ornia it is possible to have fruit matur-ng every month in the year, while in 'lorida fruit may be had from June until pril or May. Very few varieties are ommon to both states, and many differ-nt varieties are grown.

Avocado fruit is rather unusual in hav-ng the stored food chiefly in the form of at, instead of as sugar or starch. Like itrus fruits, avocados can be left on the ree for weeks after they first become dible, and they never ripen on the tree. ndeed, they improve in quality for home se the longer they hang, although there s steady loss by droppage. In Florida here is often failure to set a good crop or lack of pollination if a single tree is planted, but this seems to be a less common trouble in California. Avocados are budded or grafted on vigorous seedlings.

Mango

One of the best tropical fruits is the mango, which may be considered the peach of the tropics and matures in summer like the peach. Many seedling trees have fruit filled with stringy fibers, but the cultivated varieties are as free from fiber as peaches. Like peaches, again, the mango softens at full maturity on the tree and drops, so that picking must be done every few days. Some mango varieties are among the most beautiful fruits in the world, combining red, yellow, and purple, while others are modestly yellow or even green at ripeness. Occasional mango trees are found in the warmest parts of Texas and California, but their culture in this country is really satisfac-

Courtesy U.S.D

Mango trees may become large and bear heavily

tory only in southern Florida. Trees are propagated by budding or grafting and are rarely pruned. Bees are very helpful in pollinating the flowers for fruit set.

Papaya and Guava

The **papaya** is the most rapidly maturing tropical fruit; it is a giant herb with no real woody tissue. The fruit resembles a melon, both in appearance and in taste, and may be from 1 to 15 pounds in weight. At about five months from seed the tree begins to produce flowers, and thereafter for many years (unless cold kills it) there is a flower developed in the axil of each new leaf. The stem usually does not branch, and so after several years the fruiting area is many feet from the ground. Usually new plants are set after a couple of years of bearing. The first fruit is usually matured in less than a year from seed. Some varieties have perfect flowers, while others have only female flowers and must have a ma tree to pollinate them.

The **guava** is a fruit widely cultivat in the tropics, not so much as a dess fruit as for the jelly which is so easi made from it. There is great variati in guava sizes, and some of the larg types (weighing over half a pound) a fine for canning as guava halves. Th fruit is unusually high in vitamin C co tent, the average value being sever times that for oranges, and guava jel retains much of this. Some guavas a usually found maturing from off-seas bloom at almost any time of year, a certain types mature chiefly in winte but the main season of maturity is la summer. Until recently propagation w chiefly by seed, but air-layering mak propagation of named varieties easy f the home gardener, while veneer-graftin is now possible for the commercial prop gator.

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EW SERIES
7 No. 2

AMONG THE CONTRIBUTORS TO THIS ISSUE

EMILY L. BROWN (Mrs. Hillyer Brown) of Hillsborough, California, Guest Editor, is a garden consultant on the West Coast. She has been a member of the Brookl Botanic Garden for more than ten years.

THOMAS D. CHURCH of San Francisco is a landscape architect of note, and autl of "Gardens are for People."

HORACE F. CLAY is Associate Specialist in Horticulture, University of Hawaii Colle of Agriculture, Honolulu, Hawaii.

MRS. LAURENCE LAIRD DAVIS of Cincinnati is editor of that city's Garden Cen publication.

FLOYD C. DILLON of Mission San José, California, is a pioneer grower of dwa citrus; the Dillons originated the "Four Winds" dwarfs.

TOICHI DOMOTO of Hayward, California, is a grower of tree peonies and otl distinctive plants.

JOHN E. EDWARDS of Palo Alto, California, is a grower of camellias, daphnes, a other special plants.

WALTER H. HODGE is Head, Department of Education and Research, Longwood G dens, Kennett Square, Pennsylvania.

MRS. SIDNEY KEITH, Garden Club of America member from North Hills, Pennsylvan has won several blue ribbons for her design work with ivy.

EARL KUKLO, a member of the Oakland, California, Park Department, specializes chrysanthemum culture.

CARLTON B. LEES is Director of the Pennsylvania Horticultural Society in Philad phia, and author of "Budget Landscaping."

LESLIE MAYNE, arborist, is the Consultant Forester, San Mateo County, Californ Recreation Commission.

NEILL PHILLIPS, Rear Admiral, U.S.N. (retired), is owner of Heronwood Nursery a of a garden in Upperville, Va., which contains fine specimens of old boxwoo

MRS. W. BEAUMONT WHITNEY of Chestnut Hill, Pennsylvania, well known for l skill with wall plants, is a contributor to garden books and periodicals.

Photographers and Artist

For the drawings and photographs that illustrate this handbook on the training of plants, the editors are grateful to the following, whose work appears herein:

J. BROWN: Judith Brown, photographer, 118 Santa Maria Road, Pacifica, California.

BUHLE: Louis Buhle, for fifty years photographer at the Brooklyn Botanic Garden.

CHURCH: Thomas D. Church, landscape architect, 402 Jackson Street, San Francisco 11, Calif.

DUSTAN: Alice L. Dustan (Mrs. Samuel Kollar), garden designer, teacher, and writer, 27 DeHart Street, Morristown, New Jersey.

GENEREUX: Paul E. Genereux, garden photographer, 61 Gertrude Street, Lynn, Mass.

GOTTSCHO-SCHLEISNER: Architectural and garden photographers, 150-35 86th Avenue, Jamaica 2, New York.

GROSSMAN: Jeannette Grossman, garden photographer, 460 N. W. Greenleaf Road, Portland 1, Oregon.

HOMANS: Mary Homans, photographer, 145 Bridge Road, Hillsborough, Calif.

KELLY: George D. Kelly, nurseryman and writ Cottonwood Garden Shop, 4849 South Sa Fe Drive, Littleton, Colorado.

HUGELMEYER: John Hugelmeyer, photograph 220 West 42nd Street, New York 36, N.

LONGWOOD: Gottfried Haempfler, photograph Longwood Gardens, Kennett Square, Pen

MCFARLAND: The J. Horace McFarland Compa printers and photographers, Box 287, Har burg, Penna.

MELADY: Eva Melady, artist, who has made dra ings for many of the Brooklyn Bota Garden's handbooks, 72 Summit Aven Hackensack, New Jersey.

METHE: Frank H. Methe, a New Orleans phot rapher, of 2601 North Street.

NOBLE: Mary Noble, garden writer and edit 3003 Riverside Avenue, Jacksonville 5, F

PARKER: Maynard L. Parker, architectural a garden photographer, 2230 Lemoyne Stre Los Angeles 26, Calif.

PHOTO-ART: Photo-Art Commercial Studio, 4 West Washington Street, Portland 4, Oreg

ROCHE: J. P. Roche, garden photographer, P. Box 85, Caldwell, New Jersey.

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*This southern yew (*Podocarpus macrophyllus*), pruned in Japanese fashion to give an open effect with spaces between branches, is in the patio garden of the New Orleans Public Library, which is landscaped and maintained as a volunteer service by the Junior League Garden Club of New Orleans.

For this issue:

EMILY L. BROWN, *Guest Editor*
CAROL H. WOODWARD, *Associate Editor*
and the Editorial Committee of the Brooklyn Botanic Garden
Drawings by EVA MELADY

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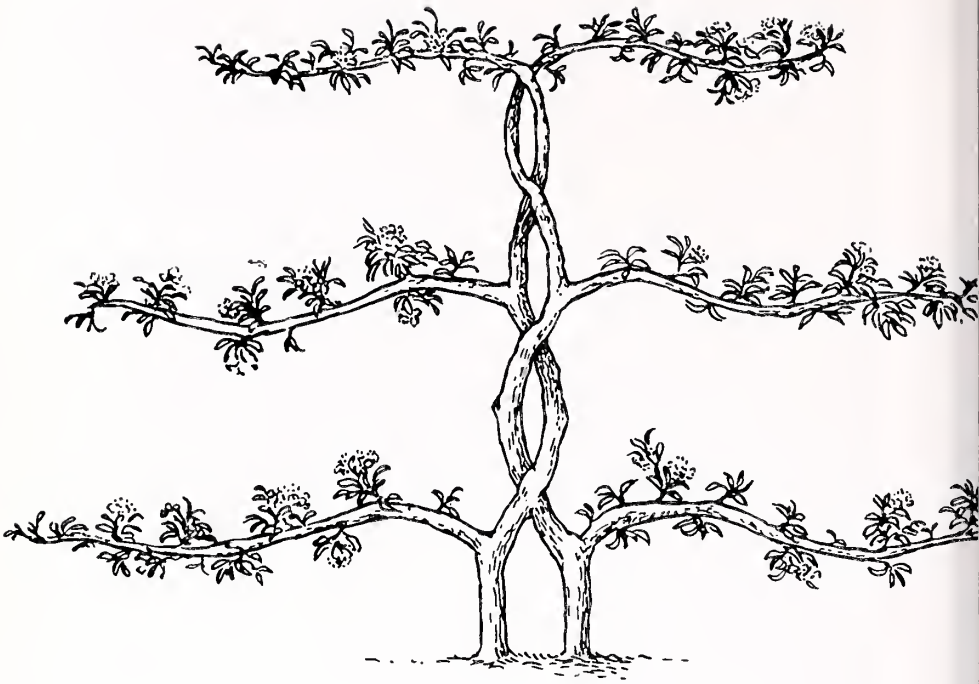

BRAIDED TREES

Braided trees are among the many horticultural novelties that any interested l
gardener can create, once he understands methods of espaliering. Sparingly used, and
proper settings, such novelties can bring originality and charm to a garden. It is t
successive branches that are braided; the bent trunk makes the first horizontal line
each specimen.

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This handbook had its nebulous beginnings a few years ago when Guest Editor Emily Brown showed me several California gardens in which she had played the role of consultant. As ideas accumulated and developed, a BBG Handbook on training plants in various shapes and forms progressed from a possibility to an assignment for Mrs. Brown. She and her collaborating authors have completed their challenging task with honors.

Trained and sculptured plants are for those who have the urge for spare-time grooming of trees, shrubs and vines—as well as for those who need and want such specialties for terraces or other situations. For those who know the secrets of producing robust and fast-growing plants, it is but one step further to develop the skill for training them into special art forms. Thomas Church treats the subject so attractively (page 5) that thousands of self-propelled gardeners who read his lines are going to try their skill without delay. Caution: Avoid the temptation of having one or two each of all the sculptured plants that strike your fancy. In short, a garden should not be turned into a horticultural zoo. On the other hand, if yours has never been a garden with a few outstanding individual plants in the over-all plan, perhaps now is the time to test your ingenuity and your taste. Let pruning tools and fertilizer be daringly used.

To grow plants well is not enough. To use them well, is better. But on top of this one must have the courage to be creative. There is a place for horticultural sophistication and for horticultural whimsy. Ornamental plants brought into urban settings need an occasional hair-do, manicure, or Dior lines.

The techniques of sculpturing plants were once the domain of professional gardeners; now they are for "everyman."

Sincerely,

George S. Avery

Director

PURPOSES OF TRAINING PLANTS

WHY train plants?

Whether the purpose in molding the form of a plant is to enhance its natural beauty or to contrive a new shape for it, a plant can nearly always be interestingly modified by skillful trimming and training.

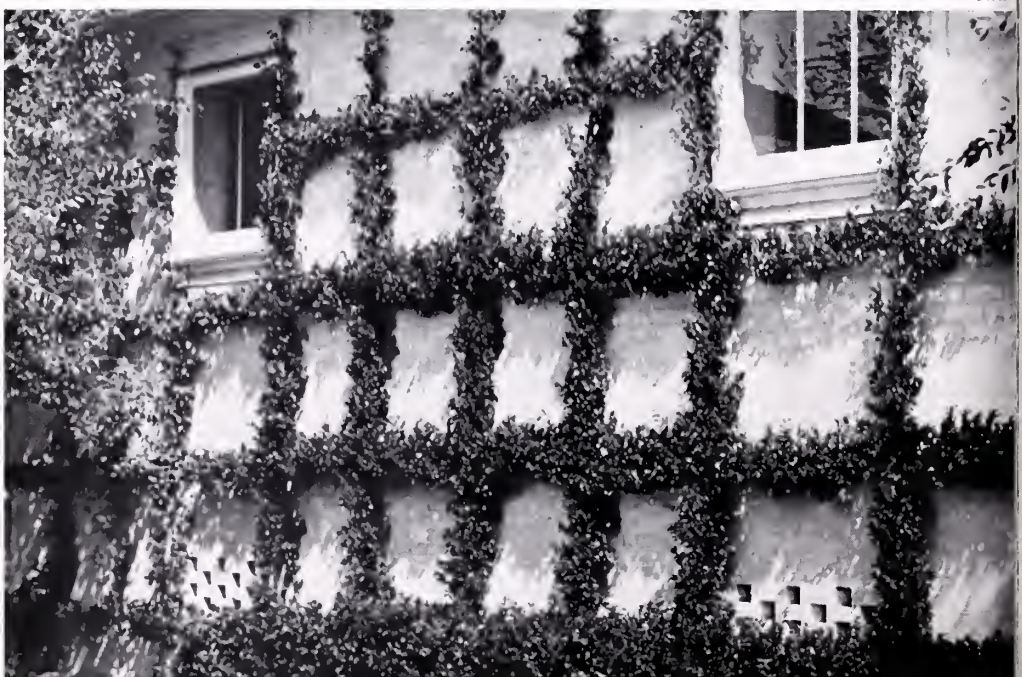
Master pruners keep in mind improvement of the component parts of a landscape. They have an eye for the aesthetic results even while removing dead, diseased, and weakened wood, and flowering branches that have passed their prime.

But training of plants goes far beyond utilitarian practices in pruning. Its fundamental purpose is to please the senses, whether it be to keep a plant within the scale of its surroundings or to clip a fine-leaved shrub into a bird. Among the possible reasons for training plants more or less aesthetically are these:

To control the size of a plant that would otherwise outgrow its environment
To accentuate natural curves or angles by removal of branches that interfere with the lines desired
To improve an outline that has been chosen for its form (as round or columnar)
To clip to a form that is not the natural habit of the plant, such as a hedge, a patterned layout, or a specimen
To "sculpture" a plant into a figure or design, as in topiary
To guide a malleable plant, such as a vine, along more graceful lines than the plant would take by itself
To direct the branches of a plant into a single plane, as in pleaching
To bend and prune a plant so that it serves as an arbor or a roof or other structure
To make a "tree" of a bush or vice versa
To dwarf a plant artificially, as in bonsai

In the pages immediately following, the place of plant form in the landscape is discussed. In subsequent pages, various kinds of training are explained and illustrated.

Chur



WHAT TYPE OF TRAINING?

Thomas D. Church

PEOPLE are all different and their personalities determine toward which end of the seesaw their type of garden will tip. Today we take the best of two schools of thought (once bitter enemies) —the formal and the informal, the symmetrical and the picturesque, the geometric and the natural, the classic and the romantic.

Whether I plant a garden with clipped hedges, pleached trees and straight lines or a garden with uneven ornamentals, irregular trees and curves will depend on what the owner likes. Is there a place for topiary in one of these designs? Yes, since topiary is whimsy and the owner may have a bit of it if he wants. When an old garden is to be redone, can much of the overgrown plant material be redone with major surgery, baring trunks of shrubs and cutting down foliage masses into many small units? Yes, if the owner has no antipathy to pruning and has a sympathy for "form." The result need not necessarily be tight pads and puffs on the ends of stringy limbs, but only natural loose clusters of foliage balancing open spaces.

When a temperament veers towards the "natural," the owner should learn that he must become a combination of family counselor, truant officer, and den mother for the control of his garden surroundings. No matter how ideal in behavior are the plants he chooses, he will increase not only the health but the grace of his garden by having the pruning shears as his constant companion.

If he belongs to the school which believes that every leaf on a tree is sacred and every branch removed is a violation of nature, let him compare his plants to man and remember the benefits of light and air and cleanliness. In these days of our fanatical concern with weight problems, how can he let his tree be overstuffed or bulging?

Of course, there is another school which needs a little direction also—its disciples incline to be clipper-happy. Their control instinct may turn any and all plants into the spheres, pyramids, etc., of their geometry days. Best teach this type to use his fancy and work out his constant shearing on a spiral or a peacock.

One can prune with artistry and in various manners. Plant materials can be living sculpture.

Look nonsubjectively at an old tree in your garden. Has its bulk become actually oppressive, has its weight overpowered the area, has its shape become merely mass—the volume of foliage way out of balance with the volume of air space? Try first lifting the foliage line. Then cut out all dead and dying wood and the less shapely of two branches which are rubbing one another. Now clear out the center a little more; it is pleasant to look up into a tree and through it as well as at it. Stand away and study it. You have obtained better scale already and soon you will be able to prune, creating artistic triumphs as you reveal shapes and lines.

Part of the value of the tree is the pattern of its shadows. Against buildings, onto the terrace and across the lawn, they provide a moving silhouette varying in intensity, changing every hour. The pat-

ARCHITECTURAL ORNAMENT. The limber branches of *Grewia caffra* are here trained in rectangles that conform to the design of the house. Any shrub with pliable growth can be handled similarly.

Churc

FOLIAGE BALANCED WITH AIR SPACE. "It is pleasant to look up into a tree an through it as well as at it." An Oregon white oak (*Quercus garryana*) trimmed for skywar view in a garden by Thomas D. Church.

tern is more distinct, more individual if the tree has been thinned and opened by pruning. If it has been pruned with a conscious exposure of its branch, twig and leaf formation, and then with a selection of the more intriguing examples of these in combination, the design will be doubly dramatic when pictured in the shadow.

When I search in the nurseries for trees and shrubs, while other people are looking for the straightest trunks, I am looking for the more crooked ones (not of course when a vertical line is needed to carry out a geometric design). Often I ask for multiple-trunk trees which perhaps the nurseryman has hidden because neglect to trim to a single stem in youth has brought forth an ugly duckling. Sometimes it is even hard to find birch with a cluster of stems, and clients who like the gentle curves of the trunks of the river birch would not take as a substitute three or four straight birches planted i a group. Other trees which are good t discover with multiple trunks are olive and madrones and evergreen elms. Thi is but an example of the care and interes we can take in our plant selection.

Now that there are very few distan views in our gardens to distract our at tention from the imperfections nearby and the garden has become "an integra part of our lives," we must aim for pe fection not only in the choice of materi but the placing of it and the maintenanc and developing of each part of it to th best of its plant ability. The final goal a sense of belonging in nature, a feelin that man is at home in his surrounding This can be attained by leaning towar either school according to one's perso ality and limiting one's picture to a fram in which one can keep adding brus strokes or eliminating brush strokes whic busy nature adds without permission.

SCULPTURING BY NATURE

Carlton B. Lees

NATURAL sculpture in plants abounds. Sometimes it is not easy to see because of a confusion of other elements in the vicinity; but it appears in gardens, along roadsides, in woodlands, and in city backyards in plants rare and common alike. Once found, it takes only a careful and light handling of the pruning shears to make the most of the riches at hand.

So many trees and shrubs present a sculptured look that this article has been limited to include only those which can be expected to develop it within a very few years after planting. No need for a muscled beech or massive oak to pass half a century—most of us are unwilling to wait that long. The riches offered here, if not already at hand, can be purchased ready-made. Given an appropriate setting and proper care they will perform nicely almost at once.

Deciduous Plants

Say "apple tree" to almost anyone, and you will conjure visions of a romantically gnarled giant, twisted in trunk and labored in posture. Probably no other tree compounds the many facets of its character into so great a visual impact as does the apple. True, the old ones are most interesting, but it is rather surprising how many of the flowering crab apples, especially the Japanese flowering crab apple (*Malus floribunda*), soon reveal their relationship to the old apple tree.

Find a Victorian house with its garden still intact and you are likely to find the sculpture of a magnificent old saucer magnolia (*M. soulangeana*). But even while still quite small most of the deciduous magnolias begin to develop distinctive form. Worthy of note are the star magnolia (*M. stellata*), and the Yulan magnolia (*M. denudata*).

Threadleaf Japanese maples (*Acer palmatum dissectum*), like all Japanese maples, develop peculiarly twisted trunks and limbs. The threadleaf variety, however, provides the most interesting contrast between the hard forms of its structure and the delicate canopy of its fernlike foliage. Similar contrast can be found in the Russian olive (*Elaeagnus angustifolia*) between the exceedingly black, rough bark and the silver white of the soft, pubescent foliage. The trunks often become wildly twisted at an early age.

NATURE ASSISTED. Italian stone pines (*Pinus pinea*), whose natural umbrella-shaped crowns have been improved by good pruning.

J. Brown

Because of their inherent growth habits, the following woody plants also provide living sculpture: flowering dogwood (*Cornus florida*), the fastigiate flowering cherry (*Prunus serrulata* 'Amanogawa') and birch (*Betula pendula fastigiata*), rockspray (*Cotoneaster horizontalis*), Tartarian honeysuckle (*Lonicera tatarica*), and Japanese tree lilac (*Syringa amurensis japonica*).

Evergreens

Because of the sensitive use made of them by the Japanese, pines come to mind first when one thinks of evergreens in relation to sculptural form. In most instances, however, these forms (in Japan) are the result of extensive training or, where found in nature, are the result of storm or fire damage. Scots pine (*Pinus sylvestris*), however, rather soon takes on an air of old age as it begins to open up to reveal its branching structure. One of the most rewarding is a multi-trunked specimen of lace-bark pine (*P. bungeana*). Japanese black pine (*P. thunbergi*), if not too symmetrical grown in the nursery row, is another candidate for plant sculpture.

Cryptomeria (*C. japonica*), while usually exceptionally straight of trunk, develops irregular masses of foliage which sometimes produce distinctly sculptural effects. Dwarf Hinoki cypress (*Chamaecyparis obtusa nana*), and Meyer's juniper (*Juniperus squamata meyeri*) also develop unusual and interesting foliage masses which are sculpture-like. One of the top plants to provide this sort of sculptured form is, of course, the beloved boxwood (*Buxus sempervirens*), but age is more often than not the provider.

For unusual forms which are often animal-like in connotation, two sprawling spruces are exceptional: the prostrate Norway (*Picea abies procumbens*) and the true Koster blue spruce (*P. pungens kosteriana*). (The more commonly known

Gottscho-Schleisner

SCULPTURED LIMBS. "Threadleaf Japanese maple (*Acer palmatum dissectum*) provides the most interesting contrast between the hard forms of its structure and the delicate canopy of its fernlike foliage."

Gottscho-Schleisner

LIVING SCULPTURE. The weeping form of the Japanese flowering cherry (*Prunus serrulata*), like the fastigiate form, is dramatic when the delicate blossoms form a backdrop for the distinctively shaped branches. (Another tree with naturally drooping, graceful limbs is the Brooklyn Botanic Garden's 'Red Jade' crab apple, which is shown on the next page.)

upright forms sold under the name have been staked to force them into an upright habit.)

The nearly prostrate English yew (*Taxus baccata pendula*) also develops unusual character if not sheared into an artificial mound, as does the Sargent hemlock (*Tsuga canadensis pendula*).

There are many more—*Mahonia bealei* among them. And one should not overlook the finely sculptured forms of some of the succulent plants—the yuccas and agaves, echeveria, and others. But whatever the plant sculpture, like a fine Rodin, it should be given a setting worthy of its quality where it can be enjoyed day in and day out, season after season, through the garden years to come.

Buhle

RED JADE. A sculptured form developed in a hybrid crab apple at the Brooklyn Botanic Garden.

SCULPTURED BY NATURE

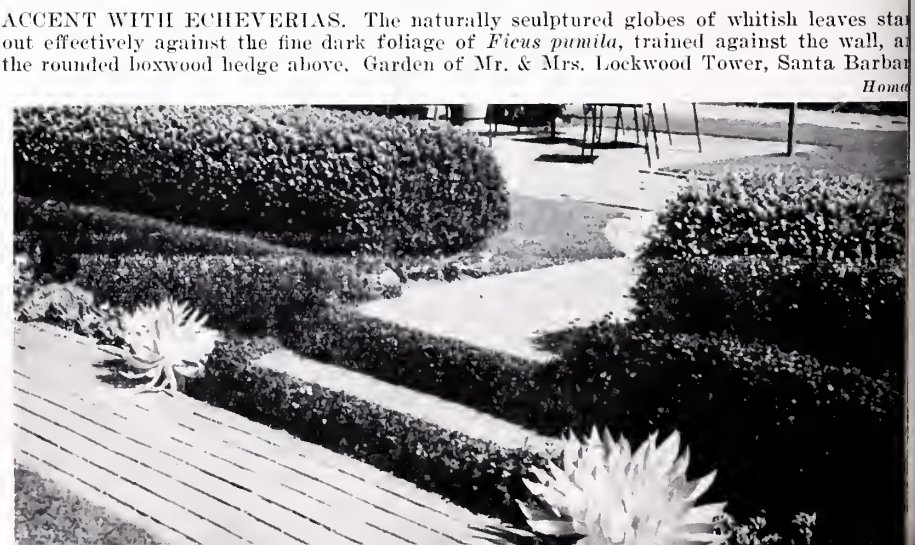
A selected list

Acer palmatum, **Japanese maple**
Agave in variety, **century-plants***
Agonis flexuosa, **peppermint-tree***
Araucaria excelsa, **Norfolk-Island pine***
Betula pendula var. *fastigiata,* **columnar European birch**
Buxus sempervirens, **boxwood**
Chamaecyparis obtusa, **Hinoki cypress**
Cotoneaster horizontalis, **rockspray**
Cryptomeria japonica
Cornus florida, **flowering dogwood**
Cupressus sempervirens, **Italian cypress***
Dicksonia antarctica, **tree fern***
Echeveria in variety (also other succulents)
Echium (shrubby, warm-climate species)*
Elaeagnus angustifolia, **Russian olive**
Fagus sylvatica var. *incisa,* **cutleaf beech**
Harpephyllum caffrum, **Kafir-plum***
Ilex crenata var. *helleri,* **holly**
I. cornuta var. *rotunda*
Juniperus squamata var. *meyeri,* **Meyer juniper**
*Kalanchoë beharensis**
Libocedrus decurrens, **incense-cedar**
Livistona chinensis, **fan palm** (also other palms)*
Lonicera tatarica, **Tartarian honeysuckle**
Magnolia in variety
Mahonia beali, M. lomariifolia
Malus floribunda, **flowering crab apple**
Morus alba pendula, **weeping mulberry**
Musa cusete, **Abyssinian banana***
Pandanus species, **screw-pines***
Parkinsonia aculeata, **Jerusalem thorn***
Picea abies var. *procumbens,* **prostrate Norway spruce**
P. pungens kosteriana, **Koster blue spruce**
Pieris forresti
Pinus pinea, **Italian stone pine**
P. sylvestris, **Scots pine**
P. bungeana, **lace-bark pine**
P. thunbergi, **Japanese black pine**
Populus nigra italica, **Lombardy poplar**
Prunus serrulata 'Amanogawa,' **fastigiate flowering cherry**
Pyrus communis, **pear**
Sequoia sempervirens, **coast redwood**
Syringa amurensis japonica, **tree lilac**
Taxus baccata pendula, **English yew**
Taxodium distichum, **bald-cypress**
Tsuga canadensis pendula, **Sargent hemlock**
Ulmus americana, **American elm**

*Starred plants are suitable for year-round culture only in mild climates.

ACCENT WITH ECHEVERIAS. The naturally sculptured globes of whitish leaves stand out effectively against the fine dark foliage of *Ficus pumila,* trained against the wall, and the rounded boxwood hedge above. Garden of Mr. & Mrs. Lockwood Tower, Santa Barbara

Homa



TRAINING WOODY PLANTS IN THE JAPANESE MANNER

Emily L. Brown

THE SHAPING and training of trees and shrubs is an ancient art in Japan. Formulated on a highly developed sense of design, it uses a traditional and meaningful set of values for producing an ideal garden atmosphere.

Whatever type of landscape is to be portrayed—a quiet retreat, a place of detachment from everyday living, an expression of permanence and antiquity, a reminder of a familiar scene in the country—each plant selected must contribute to the scene. Plants are grown less for horticultural interest than for the scale, form, line, and texture they add to the completeness of the garden's design unit; even flowering shrubs and trees are used more for permanent shape than for bloom.

Nature Reflected

Yet it is felt that no plant should be chosen or shaped to create a bizarre effect; all should reflect nature and should blend with the surroundings. Strange shapes are therefore not to be found in the Japanese garden. While topiary is occasionally used,[1] it is a great exception to the general practice, since it is out of harmony with natural forms. The severe clipping of azaleas by the Japanese seems unnatural to many westerners but we westerners clip boxwood in much the same way. The difference is that we seldom relate our mounds, domes, and other

[1]See the Treasure Ship in the garden of the Golden Pavilion, Kyoto.

ORIENTAL PRUNING. Evergreens being pruned in authentic manner by gardener Frank Okamura in the Brooklyn Botanic Garden's Japanese garden.

forms to the curves and planes of the surroundings.

Background trees in the Japanese garden are carefully planted and trimmed to produce a feeling of depth, those in the foreground being made thinner. Deciduous trees are pruned to select and develop their best lines of trunk and limb. While gnarled or moss-covered trunks are of course exposed, smaller branches with interesting tracery are also made visible.

Evergreens Dominant

Because the Japanese garden is for day-by-day, year-round enjoyment, it is primarily a green garden; the proportion of evergreen to deciduous plants is high —often more than seven to three, sometimes four to one. The earliest flowers of the plum trees and the poetic flowers of the single-flowering cherries, as well as the waxy blooms of deciduous magnolias are prized, but not in quantity. They are valued most on trees whose growth is rigidly controlled. When wisteria is grown, though the pendent flowers are beautiful, the wood is looked upon as the vine's most important asset.

Colored leaves and buds and even snow

CLIPPED AZALEA. Trimmed in the Japanese fashion to maintain a low mounded form, this azalea beside a pool contrasts in texture with the rock of similar outline in the immediate background.

Grossman

are considered as decorative as flower In fact, the "winter blooming" created b snow is really the only blooming that not sacrificed to form, but only becau the two purposes coincide: formation horizontal planes brings about natur platforms for the snow "blossoms." special type of pruning called "peon style" (by the West, sometimes pancak style) is occasionally practiced with eve greens to provide nests for drifting snow *Chamaecyparis obtusa nana* is mo adaptable for training for this "winte blooming."

Flowers on broad-leaved evergree shrubs are never saved. Buds will b clipped from azaleas when the bush woul be out of scale if left untrimmed. Came lias are occasionally grown in hedge sometimes 20 feet high, but the folia mass is made flat on top and sides witl out regard for the bloom that is bein surrendered to the shears. Other eve green shrubs may also be given flat to (while their sides are left rounded sometimes to repeat another horizonta line, such as that of a stone bridge. Whil many shrubs are trimmed to the shape hillocks, others may be clipped in asym metrical shapes, but again to balance ar other architectural feature, such as a roc or a curve in a path or the pattern cr ated in raked sand.

Airy Effects

The training of some plants to for massed shapes is counterbalanced by th training of others to produce airy, lac silhouettes. Pine trees probably take an are given more training than any othe plant in the Japanese garden. Togethe with other trees they are pruned for sev eral purposes: to allow a view betwee the branches, to allow sunlight to filte through to a shaded area, to produc clean lines, to maintain scale in the gar den.

How Pines Are Trained

The pine apparently responds to train ing better than any other tree. In de veloping a look of antiquity, for instance a pine can be planted at a severe angl over a pool or path or out of a rockery

It will be propped and tied, incidentally to protect it from wind, but fundamentally to give it the look of age. Branches may be shortened and, if allowed to twist or bend, the tree soon becomes a reminder of those trained by weather through the years at the seashore or in the mountains.

As a pine tree is thinned, its branches elongate quickly (there is special acceleration of growth when they spread over water), and this outward sweep produces a desired horizontal line. The upsweep of the ends of pine branches gives another graceful line to be accentuated. When a tree can be reflected in water another dimension is added.

The training of pines varies somewhat according to species. The red pine (*Pinus densiflora*) is considered feminine, the black pine (*Pinus thunbergi*) masculine; the five-needled pine (*Pinus parviflora*) is one which lends itself superbly to training as a patterned tree. Sometimes it may be seen trained with the extreme care whereby all tender center shoots are removed and the foliage is thinned. All pines can be given the intricate technique needed for perfect dwarfing.

Decorative Trellises

Trellises are sometimes used for training pines and other conifers, as well as flowering trees; they are very helpful when plants are to be shaped. Low trellises are sometimes used to develop a low sweeping line in the bottom branches; sometimes very high ones (far higher than we customarily build in America) are set up where a horizontal plane is needed in the upper part of the tree. Some trellises are pitched instead of flat, some are multiple, but all are decorative both in proportion and material.

Training of trees and shrubs in Japan often requires the aid of a professional. It is accomplished in two general cleanings, spring and fall. At those times, all small branches are thinned, new sprouts are trimmed back, and shaping is improved; but in every season and every day the pruning shears are always near at hand.

A number of other plants besides those mentioned are regularly trained in Japanese gardens. Others which nature has sculptured are chosen when they suit the landscape being created. But even those which nature has shaped attractively often need the clippers to maintain the high standards of orderliness and cleanliness demanded by the Japanese.

If the training of plants in the Japanese manner seems over drastic or even contrived in its extreme examples, the principles may be applied in moderation with increase in the beauty of many plants in many gardens.

J. Brown

REVEALING ITS AGE. An old shrub of *Euonymus* pruned to expose the angles it has developed during its long life.

CLIPPED HEDGES, PLEACHED TREES, AND GUIDED VINES

THE TRIMMING and training of plants to alter their contours, density, or direction of growth has, like other aspects of training, a twofold purpose: practical and aesthetic. Hedges are clipped, vines pruned and trained, and trees pleached to achieve better growth and to develop a pleasing form. Trees, shrubs, and vines may also be espaliered—flattened against an upright support and trained in a single plane (see page 26).

These forms of restraint in the growth of plants are all ancient gardening practices, some of which, until recently, have been more or less overlooked. Today, with smaller outdoor areas around homes, their revival is appropriate.

The clipped hedges and pleached trees that have been used in Europe's vast formal landscapes over the centuries, and have also marked some of America's famed colonial gardens, are remarkably well adapted to the small home gardens of today. Plants for courts, enclosed gardens, terraces, patios, and lanais must generally be controlled to keep them in proportion to their surroundings. The narrow planting strip of today's small properties also requires plants that can be kept limited in size. Outside walls can be made more attractive with only a tracery of stems and leaves against them, rather than thick, unpruned masses of foliage. Even with selection of the less rampant species of vines. deliberate restraint of growth is desirable.

Manipulation of woody plants can contribute as much to the artistic effect of a garden as to its practical aspects. In fact, no project begun for practical purposes (such as limiting growth) should be continued unless it also serves the aesthetic.

A hedge, whether its top is flat, depressed, or rounded, or trimmed at intervals into geometric figures, needs to set off and ornament the garden from within, as well as protect it from without. A row of pleached trees can be a thing of beauty in itself while it gives its planned, limited shade. Vines, indoors or out, are natural ornaments; but those that are held within bounds by pruning and training give the greatest aesthetic satisfaction.

HEDGE FORM. Topiary hedge exhibiting the motif of a garden by the late Lockwood deForest at Santa Barbara, California. A template of plywood is used for shaping.

Homan

WINGS AND CURVES. Staggered lines and angular shadows are formed by the wing hedge (*above*), actually a mock hedge of English ivy on a wire frame. The curved hedge (*below*) repeats the line of the path. Both are in gardens designed by Thomas D. Church.

Church photos

Chur

TRIPLE HEDGE. In this enclosure at the Tuileries gardens in France, all three banks a alike. Some triple hedges are made of more than one kind of plant.

PLANTS FOR HEDGES

A selected list

Trees†

Casuarina stricta, Australian pine*
Cedrus atlantica var. *fastigiata*, fastigiate Atlas cedar
Cryptomeria in variety
Cupressus in variety, cypress
Fagus sylvatica, beech
Melaleuca leucadendra, cajeput-tree*
Pinus mugo, mugho pine
Pittosporum in variety*
Podocarpus in variety*
Thuja in variety, arborvitae

Shrubs, Unclipped

Abelia floribunda
*Ardisia japonica**
Azalea in variety
*Brunfelsia calycina**
Chaenomeles lagenaria, flowering quince
Chamaerops humilis, European fan palm*
Choisya ternata, Mexican orange*
*Coleonema pulchrum**
*Corokia cotoneaster**
*Correa neglecta**
Diosma reevesi,* *D. ericoides**
Euonymus alatus compactus
Hebe elliptica (*H. menziesi*), veronica*
Ilex microphylla
Leptospermum recvesi, tea-tree*
Lonicera tatarica
Mahonia in variety
Michelia fuscata, banana-shrub*
Nandina domestica, heavenly-bamboo*
Nerium oleander, oleander*
Osmanthus in variety*
Pieris japonica
*Pittosporum eugenioides**
Podocarpus macrophyllus, southern yew*
Rhaphiolepis indica, India hawthorn*
R. umbellata, Yeddo hawthorn*
Rhapis excelsa, lady palm* (also other palms*)
Rhododendron (dwarf forms)
Rhus ovata, sugar-bush (sumac)*
Rosa (dwarf forms)
*Skimmia reevesiana**
Spiraea bumalda 'Anthony Waterer'
S. vanhouttei
Taxus media hatfieldi, *T. m. hicksi*
*Viburnum suspensum**

To Shear Only Occasionally

Acer campestre, hedge maple
Acer ginnala, Amur maple
Caragana pygmaea, pea-shrub
Cornus mas, cornelian-cherry
Elaeagnus commutata, silver-berry
Larix decidua, European larch
Punica granatum var. *nana*, dwarf pom granate*
Quercus imbricaria, shingle oak
Rhamnus frangula 'Luedy', fastigia glossy buckthorn
Rosmarinus officinalis, rosemary*
Salix purpurea nana, dwarf purple osier
Syringa chinensis, Chinese lilac
Taxus var., Moons columnar yew
Teucrium chamaedrys, germander
Tsuga canadensis, hemlock
Viburnum opulus nanum, dwarf cranberry bush

†Fruit trees are also recommended, to be used as vertical or horizontal cordons.
*Starred plants are suitable for year-round outdoor culture only in mild climates.

PLANTS FOR HEDGES. *Euonymus alatus* forms a tall heavy hedge that is colorful in autumn (*left*). Garden of Mr. & Mrs. W. Everett Rowley, Hanover, New Jersey. In a large perennial garden in Ireland, beech is used as a hedge to separate different plantings and to arch over the walks (*right*).

Clipped or Unclipped

Berberis in variety, **barberry**
Buxus in variety
Euonymus in variety
Hedera helix, **English ivy**
(trained in a mound over wires)
Ilex in variety, **holly**
Lavandula officinalis, **lavender**
Ligustrum quihoui, *L. vicaryi*, *L.* 'Suwannee River,' **privet**
Lonicera nitida, **honeysuckle**
Myrsine africana, **African box***
Myrtus compacta, **dwarf myrtle***
Prunus ilicifolia, **islay***
P. laurocerasus, **cherry-laurel***
P. lyoni, **Catalina (Islands) cherry***
Santolina chamaecyparissus, **lavender-cotton**
S. virens
Ugni molinae (*Myrtus* or *Eugenia ugni*), **Chilean guava***

BOX-EDGED PLANTINGS. In Colonial Williamsburg closely clipped boxwood surrounds triangular beds in the Custis-Maupin garden. *Roche photos*

TREES FOR PLEACHING

A selected list

Carpinus, hornbeam
Crataegus, hawthorn
*Gardenia jasminoides**
Hibiscus tiliaceus, hau*
Platanus, plane
Pyrus, pear

VINES THAT LEND THEMSELVES TO TRAINING

A selected list

For Design Tracery

Akebia quinata, five-leaf akebia
Clematis in variety
Euonymus in variety
Hardenbergia comptoniana, vine-lilac*
Hedera in variety
Quamoclit pennata, cypress-vine*
*Trachelospermum asiaticum**

For Cascading

Antigonon leptopus, rosa de montana*
Gelsemium sempervirens, Carolina yellow jessamine*
Philadelphus mexicanus, Mexican mock-orange*
Polygonum auberti, silver-lace vine
Rosa (arching species and varieties), rose

Woody-stemmed, for Trellises

Bignonia (and related genera), trumpet-creepers*
Celastrus scandens, American bittersweet
Hydrangea petiolaris, climbing hydrange
Lonicera in variety, honeysuckle
Solandra guttata, chalice-vine*
Schizophragma hydrangeoides Japanese hydrangea-vine
Trachelospermum (*Rhynchospermum*) *ma daianum**

For Pergolas and Arbors

Actinidia arguta, tara-vine
Cissus capensis, evergreen-grape*
Clematis armandi, evergreen clematis*
*Tetrastigma voinierianum**
Trachelospermum jasminoides, Confedera jasmine*
Vitis in variety, grape
Wisteria in variety

For Panels and Pillars

Hibbertia volubilis, Guinea-gold vine*
Ipomoea leari, dawn-flower*
Mandevilla suaveolens, Chilean jasmine*
Parthenocissus quinquefolia, Virginia creeper

CONIFER BORDER. Several of the needle-leaved evergreens—notably hemlock, yew, press, arborvitae, and pine—can be clipped satisfactorily into hedge form. Here a bro band of mugho pine is kept closely trimmed to edge a property without obscuring the vie

McFarla

Parker

CONNECTING LINK. Branches of a plane tree within a garden wall are interlaced with those of the trees outside. High, light shade is thus provided for garden and street without branches interfering with traffic. Garden design with pleached trees by Thomas D. Church.

HOW TO PLEACH

Leslie S. Mayne

PLEACHING is the interweaving of branches of trees or shrubs to form a somewhat solid mass with one or more flattened surfaces. The process, which involves pruning, bending, tying, and interlacing, is sometimes called plashing.

Whereas, in almost all other pruning, branches that touch or cross are removed, in pleaching most of them are kept. Often they intertwine naturally, especially the smaller ones, but the intertwining may be assisted by bending, turning, and (if necessary) by tying. Plants with tough but elastic wood are best for pleaching. Supports may be used but, with exceptions, only temporarily.

J. Bro

HORIZONTAL EFFECT. Pleached plane-trees carry out the long straight line of the wa beneath them in the California garden of Osgood Hooker.

The purpose of pleaching is to form either a hedgelike wall or an arbor or a canopy. In the first case the flattened plane is vertical, in the second and third, horizontal.

The trunks are trained to be clean an straight and are planted equidistan Most of the front and back branches a cut off; these are kept pruned to a smoo even line. The top and lower branch

GARDENIAS PLEACHED. In the New Orleans garden of Mrs. Edgar B. Stern, Sr., tre form gardenias have been interlaced to form a continuous band of flowers and foliag Pleaching by Osmond J. Ward. Me

Roche

SUPPORTED VINE. Wisteria, blooming on a rooftop, is given added beauty by being held away from the framework of the house by long V-shaped metal bars.

are trimmed to form level planes. The side branches are encouraged to spread toward the adjacent trees and are interwoven as they mingle.

When trees or shrubs are to be trained to form a covered alley or an arch or pergola by pleaching, selected young trees are allowed to develop a full round crown at the desired height; then, if the branches of each tree do not meet the branches of the adjoining tree, horizontal wires should be placed, onto which the horizontal branches can be tied.

The upright branches are then removed without leaving any vertical stubs which would produce vertical growth. Branches may be splayed (spread out) to force them to grow toward their neighbors. So that they may be more easily bent, branches may sometimes be cut partly through. All new growth which fits into the plane of the canopy is periodically tied down to the wires. When the branches of adjacent trees cross, these branches are intertwined. Ultimately these intertwined branches will form natural grafts and the canopy of lacy foliage will produce a complete foliar ceiling.

Pollarding

Sometimes confused with pleaching, pollarding of trees and shrubs consists of the annual cutting back of branches to the trunk, in order to induce new growth to appear. Sometimes this is done with decorative intent, as in the pollarding of catalpas to keep the head of foliag low and small. More often it is done fo a craftsman's purpose, as when willow are cut back to force the growth of slen der branches for basket-making. Pollarde trees are frequently seen bordering farm in Europe, also on streets in Tokyo.

Roch

AIDS TO TRAINING VINES AND SHRUBS

Emily L. Brown

IS IT NEEDLESS to say that the support for a plant should be inconspicuous? An exception would exist only if the trellis itself were to be featured. If wire is to be the support, it should be new, of proper size, absolutely taut and, for right-angled espaliers, on exactly horizontal and vertical lines. A trellis or wire should generally be erected before the plant is put in, and it should cover the maximum height and breadth expected. Wires should always be held away from a wall—the larger the stem of the plant the farther away. When parallel vertical wires (from ground to roof line) are used for twining vines, the lower end of the wire must be attached to a long pipe or wooden stake driven into the earth.

Only temporary guidance is required for clinging vines,* just enough to hold stems close to a wall until aerial roots begin to attach themselves. A light prop can be made of bamboo stakes or a piece of hardware cloth.

Other vines and scandent shrubs are held in place by securing the new growth to various nails or screws at strategic intervals as they grow. For wooden walls an old-fashioned type of support is the sharp-pointed roofing nail. A knot of raffia or florist's string is tied beneath the broad head, then another knot is tied around the stem with about ¼ inch slack, to allow for play. The staple, which makes its own loop over the stem, is definitely not recommended; it holds the stem too close to the wall and, as the stem thickens, it becomes too tight. Binding is to be avoided in all methods of supporting vines or vinelike growth.

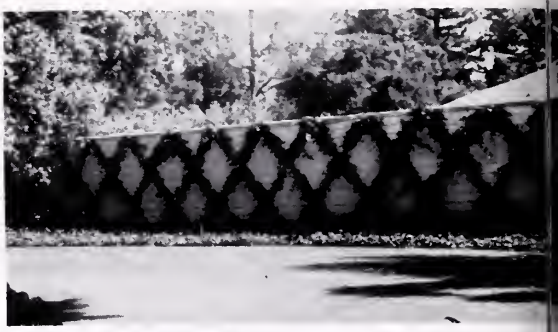
Shown opposite are several nails, hooks, and screws which do a good job in guiding stems of plants and in holding wires to which stems are tied. Wall nails (*upper right*) designed as electrical and wireless leads have a hooked metal piece which will support either stems or wires. The vine guide and supports (*right and lower right*) designed for small and medium stems come with a glue for attaching them to walls. Ordinary hook-eyes come in different sizes and special hook-eyes are made with ends of cork which expand when driven into a hole drilled in a wall (*lower center of picture*). "Molly screw" is a name to use when asking for screws to use in stone or brick or other hard material which necessitates drilling. "Stand-off" screws have long shanks, the longer the shank, the farther the wire will be held away from the wall. The group of three fancy gadgets (*left*) used as TV antenna guides serve excellently for holding wires which need to be well out from the wall.

Vines that have many side branches may sometimes be trained to form a solid flat mass. Gardening string or other soft but strong material may be tied at either side to "stand-off" screws (hidden in foliage). The ceiling or screw-hook (*center*) is the piece to buy when wires are to be led from the ground to the roof overhang. The large object (*upper left*) is for the heaviest wire, to be used for trees being trained on a trellis; it consists of a floor flange, a pipe nipple and a clamp.

To train any plant, suitable equipment of excellent quality makes the operation easier and the result neater.

*Only a few non-clinging vines should be allowed to hug a wall, *i.e.*, those which can be kept thin and open.

ENGLISH IVY
CAN BE TRAINED
OR TRIMMED
TO SUIT ANY TASTE



ee also illustrations of
ained English ivy on
ages 15, 52, 54, and 63.

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omans, Church, Grossman,
rown, Morton; page 25—
omans, Genereux, Gross-
an, Church.

ESPALIERS AND OTHER FLATTENED PLANTS

THE WORD "espalier" is rather loosely used today. It is derived from the Italian word "spalliera," which comes from "spalla" (shoulder). In horticultural parlance it first referred merely to a trellis on which fruit trees or shrubs were trained flat. It then came to mean a tree or row of trees so trained. Probably on the first espaliered trees the branches were all bent at right angles, hence the use of the word "spalliera," which, in Italian, still means any kind of shoulder support (for example, a chair back). "Espalier" came into the English language in the seventeenth century. While the word is variously pronounced (sometimes with a long a, sometimes as though in French), the correct pronunciation is es-pal'-yer with a short a, as in **pal** (which carries the accent), and with the final syllable pronounced **yer** as though it rhymed with **her**.

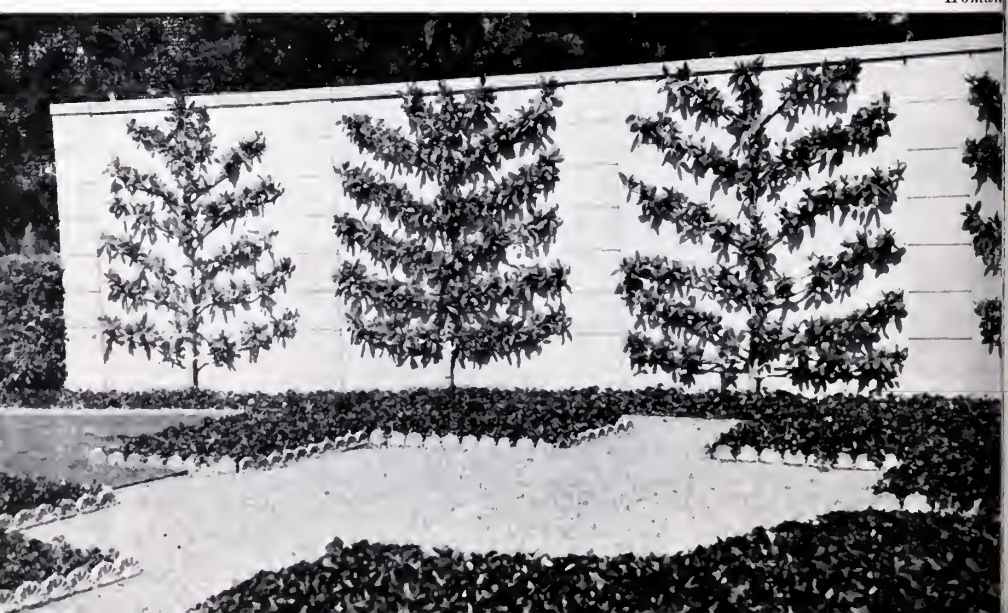
Many persons call any plant growing against a wall an espalier, whether or not it is attached to a trellis, and whether or not it is trained with right angles. At the other extreme, some use the word to specify one particular symmetrical design, as shown in the chart on espalier patterns (page 35). Here there is also a design called "random"; this might be similar to "free form" but should never be allowed to deteriorate into "wandering."

A cordon is generally considered a form of espalier, even though no trellis is required. The word is derived from the French meaning "cords" or "rope." Each branch of a cordon is trained in but one direction. The simple cordon has only one main (skeleton) branch when trained vertically; two, growing in opposite directions, when trained horizontally; there can be double, triple, even oblique cordons, however. All more or less simulate a fence, as shown in the drawings.

Several of the photographs show other types of espalier, some without apparent support. In accordance with these varied examples, the widest meaning of espalier today might be "any flattened tree, shrub, or vine trained in any design."

ESPALIERED MAGNOLIAS. In the Sterling Morton garden, Santa Barbara, California specimens of *Magnolia grandiflora* have been trained against a garden wall. Because of th heaviness of the wood, this tree requires special skill to handle.

Homan



Genereux

FLOWERING DOGWOOD. *Cornus florida* as an informal espalier, at the Connecticut home of M. E. Cox.

ESPALIERED SHRUBS AND TREES

Mrs. W. Beaumont Whitney

AN ESPALIER is a tree, shrub, or vine trained in a vertical plane against a fence or wall. Because the development of an espalier demands major surgery as well as periodic pruning, the process should never be attempted by gardeners who are timid clippers.

When an espalier is being planned, it should be looked upon as an architectural feature. What design will enhance the chosen spot? What plant will lend itself to the design? How will the natural habit of growth and the ultimate size of the plant fit into the picture? (Scale is of

utmost importance.) Will the plant's branch and foliage textures harmonize with the surroundings?

There are two main types of espalier, the traditional or formal and the free, imaginative, informal style of training. In the free style, there is no set pattern to follow, the design being more or less determined by the plant's natural lines of growth. In formal style espaliers, on the other hand, there are many established designs that the traditions of three centuries have handed down to the growers of today.

Formal

To espalier a contrived pattern, such as a candelabrum, a heavy frame should be constructed or the design should be laid out on the background with chalk. Masonry nails are hammered in at intervals along the design. Copper wire or bellcord is tightly strung on these and twisted around each nail, the ends being fastened securely.

A small plant with a tall leader is best. All of the poorest side should be cut off. This flat side should then be planted as close to the fence or wall as the root-ball will allow. Any side branches on the leader which may be bent to follow the lines of the design should be retained and tied to the wire with nylon cord. While bending these branches, great care must be taken not to break them. All other branches are trimmed off.

As the plant grows, the leader and selected side branches are tied again, the latter being carefully bent to follow the pattern. All branches growing outward should be trimmed to within four inches of the wall or fence. With flowering plants a little leeway may be taken in trimming back these projecting branches. While it is desirable to retain as many blossoms as possible, both flowers and berries must be sacrificed when they interfere with the design.

Informal

For casual or free espaliers, a young plant with pliable branches will be most easily worked into a desired pattern. This pattern will not be a symmetrical one, nor even a strict one, but it will be a some-

Homans

Trained firethorn (*see caption opposite*).

what manipulated and considerably flattened version of the plant's natural habit, modified in such a way that it will effectively decorate the wall space. A plant that is rangy or one-sided instead of well rounded should be selected. Often wind, weight, or even injury may have started an interesting pattern in a plant; a chance bend or twist of this sort will predict the ultimate design.

(*Concluded on page* 30)

ADAPTABLE PYRACANTHA. Firethorn (*Pyracantha coccinea*) trains readily in either formal or informal style. When shaped into a precise design (*as on the opposite page*), it requires constant grooming. In colder climates the variety *lalandi* is more frequently grown. This is shown (*below*) in a simple espalier design against a frame house. For those who want a natural effect with a minimum of restraint (*right*) a little thinning out of heavy branches will give an airier and tidier appearance.

McFarland

Roche

Homans

Grossman

CHIMNEY TREATMENTS. Shadows from the leaves of loquat (*Eriobotrya japonica*) were a planned feature of the espalier (*left*) in the Sterling Morton garden, Santa Barbara. Red bark of bearberry (*Arctostaphylos uva-ursi*) shows up strikingly against white brick (*right*). The plant has been trained upright on metal hooks.

Similar methods of planting, bending, or trimming are followed as for a formal espalier. But no frame or wires are necessary for informal training[2]; the plant is not required to follow a design foreign to its natural growth. The pattern the plant suggests, however, is accentuated by guiding the branches, as the plant grows, by tying the tips to masonry nails that are driven into the wall.

General Care

Root pruning is advisable in early spring to encourage bloom on flowering plants and to maintain a balance of top growth and root system. A spade is forced the length of the blade around the plant in a circle measuring about one foot in diameter to each inch of trunk or stem diameter.

Evergreens on a south wall should be protected against winter burning. A discarded Christmas tree or other greens fastened against the espalier is effective.

A large variety of trees and shrubs, both deciduous and evergreen, can be espaliered easily. Though the effect to be produced is of primary importance, choice must also be guided by sun, shade, reflection (if against a wall), soil requirements, space for roots, and other factors.

A wall plant, like a picture or a tapestry, is on display; it should be not only well chosen but also well groomed.

[2]*Editor's note:* For tough-stemmed plants, with somewhat undulating stems, such as climbing hydrangea, aluminum wire of heavy gauge, pushed into the ground and bent to the pattern behind the stems, can help to flatten the plant.

PLANTS FOR TRAINING AGAINST WALLS

A selected list

Trees and Shrubs

Abelia grandiflora, glossy abelia
Abutilon in variety, flowering-maple*
Agonis flexuosa, peppermint-tree*
Berberis nevini, barberry*
B. julianae, wintergreen barberry
Buddleia magnifica, butterfly-bush
Camellia japonica
Camellia sasanqua
Carissa grandiflora, Natal plum*
Ceanothus in variety*
Chaenomeles lagenaria, Japanese flowering quince
Citrus in variety*
Cornus florida, flowering dogwood
Cotoneaster horizontalis, rockspray (and other species)
Crataegus phaenopyrum, Washington thorn
Eriobotrya japonica, loquat*
*Eucalyptus preissiana** (and other species)*
Eugenia smithi, lilli-pilli*
Feijoa sellowiana, pineapple-guava*
Forsythia in variety, golden-bells
Genista monosperma, bridal-veil broom
Grewia caffra, lavender starflower*
Hydrangea quercifolia, oakleaf hydrangea
Ilex opaca, *I. aquifolium*, *I. cornuta burfordi*, and others, holly
Jasminum nudiflorum, winter jasmine
Kerria japonica
Laburnum alpinum, Scottish laburnum
L. anagyroides, golden chain
Leucodendron argenteum, silver-tree*
Magnolia denudata, Yulan magnolia (and other species)
M. grandiflora, evergreen magnolia, bull bay
Malus floribunda, flowering crab apple
Malus in variety, apple
Philadelphus in variety, mock-orange
*Pileostegia viburnoides**
*Podocarpus elongatus**
P. macrophyllus, southern yew*
Prunus in variety
Psidium cattleianum, strawberry guava*
Pyrus in variety, pear
Pyrus kawakami, evergreen pear*
Pyracantha coccinea vars. *lalandi*, 'Kazan', 'Weavers Superb,' and others, firethorn
Rhododendron in variety
Rosmarinus officinalis, rosemary*
Sorbaria aitchisoni, false-spirea
Tamarix pentandra, tamarisk
Taxus cuspidata or *T. media* (dwarf forms), yew
Viburnum carlesi (and other species)
V. rhytidophyllum, leatherleaf viburnum
Weigela florida
*Xylosma senticosum**

Vines

Celastrus scandens, American bittersweet
Hydrangea petiolaris, climbing hydrangea
Lonicera in variety, honeysuckle
Rosa (climbing forms, also dwarfs), roses
Wisteria floribunda

*Starred plants are suitable for year-round outdoor culture only in mild climates.

Genereux

FORMAL FORSYTHIA. Skillful training has transformed an abundantly flowering shrub into five slender parallel lines of yellow bloom against the dark clapboards of a house.

TRAINING FRUIT TREES AS ESPALIERS*

Emily L. Brown

SELECTION of healthy stock is of paramount importance, no matter what the variety, when a fruit tree is to become a featured specimen. For espaliering, six-year-old fruiting dwarf and semidwarf plants of all kinds and shapes are available, already partially trained to a predetermined form. These have been budded by experts on clonal rootstocks (Malling II, IV, VII, or IX, according to the trees' needs). The position and function of the tree will have some influence on its future development, but our problem will be to continue the basic pattern begun at the nursery. If a support is to be provided, the size and form must be made to fit the tree. This is best done after the tree's arrival. The tree will not have attained its full height, if it is an upright; or its full width if a horizontal. But by careful pruning the owner will carry forward and maintain a design in keeping with the established structure.

Espaliered fruits need trimming in two distinct periods in the year, the dormant season and the growing season. The main pruning takes place in very early spring, just before the sap begins to run. This can be called dormant or winter pruning.

For vertical shapes, while the tree is still attaining its desired height (which may be from 5 to 12 feet), the last year's top growth is pruned to one-half its length. After full height is reached, top growth is cut back to one eye each year.

In palm shapes, the inner leaders should be kept 6 inches shorter than the two end leaders. The side shoots are cut to 4 inches.

In fan shapes, the side shoots protruding outward are cut to 4 inches. Other side shoots are cut to 8 inches.

The main pruning of peaches and nectarines requires special treatment. Of two new branches produced in the growing season, one is left and the other is pruned to two eyes, keeping the branch with the most bearing spurs. This will be recognized easily, as the blooming eyes are doubled. Side shoots on peach and nectarine trees are cut to 6 inches.

The main pruning for cordons differs in that the ends are not pruned until they have reached the desired length. Side shoots are cut back to 6 inches. They may be pruned to less after the tree has reached maturity. About one-third of the shoots on top of horizontal leaders are thinned out to admit light. (Most of the fruit is borne on shoots along the outer sides.) Apples and pears are most commonly used for cordons.

Summer pruning of fruit trees, although not so extensive, is also essential. The side shoots should be cut back at least once a month, in July, August, and September (over a longer period in mild climates), to lengths which are similar to those for the main pruning. For example:

vertical-branched trees, apples, pears and other fruits not given special mention below—to 4 inches
fan-shaped trees—to 8 inches (except outward growing shoots to 4 inches)
peaches and nectarines—to two eyes
cherries—to 3 inches (they should be pinched back often)
cordons—to 6 inches

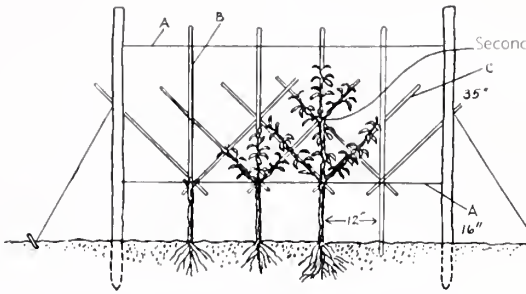
(*Concluded on page* 34)

*The presentation of these directions for espaliering of deciduous fruits has been inspired by the works of Karl D. Brase, Associate Professor, Department of Pomology, Cornell University, and two of America's foremost commercial specialists in the growing of dwarf and espalier-trained trees: Sigward Edstrom, proprietor of the United States Espalier Nursery Company, Sherwood, Oregon, and Henry Leuthardt, Port Chester, New York, The Henry Leuthardt Nursery.

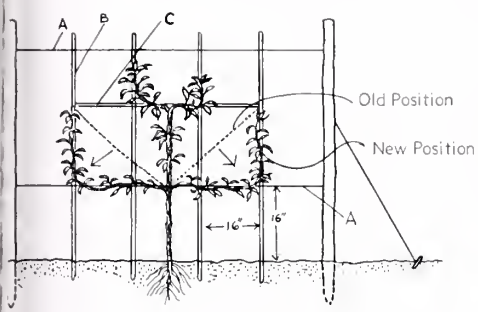
How Fruit Trees are Trained To Special Forms*

The Fan-shaped Palmette

Two wires† are necessary for training. The upper one should be about 50 inches and the lower one 16 inches from the ground. The 1-year whip has to be cut back to about 16 inches above the ground so that only three well-developed buds are left above the lower wire. These three buds have to form the main skeleton of the tree. They should be in such position that the uppermost bud, which has to form the leader, faces to the front and the others right and left as much as possible. The buds along the whip below the wire are best removed by rubbing them off. As soon as the new growth has attained a length of 10 to 12 inches, the actual training begins.



The uppermost shoot is tied to a vertical lath and the two lateral shoots are tied to laths fastened to the horizontal wires at an angle of 45°. If the growth of the shoots varies, uniformity can be attained by pinching off the longer one. The same procedure is followed the next season to form a second series of lateral branches. The leader is cut back to about 16 inches measured from the crotch of the last season's lateral shoots. The lateral shoots are cut back to about the same length.



Verrier Palmette

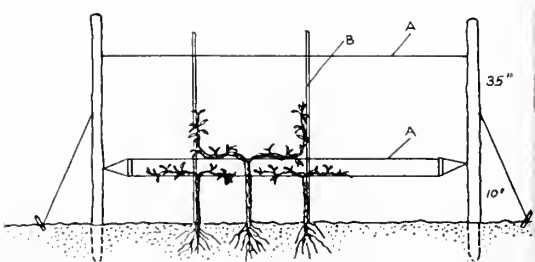
To train a Verrier palmette, select a uniformly developed fan-shaped palmette with two laterals and one leader. The lateral branches are brought into a horizontal position and tied to a lath. The leader is cut back to about 16 inches measuring from the lateral branches. All buds except the two upper ones are removed from the leader. These two buds, after they have started growth, will be trained in very much the same way as described with the U-form (below). The distance between the branches should be always about 16 inches.

Horizontal Cordons and U-Forms

Best results are obtained from budlings, *i.e.*, the first season's growth after budding. Wires are placed in much the same way as described above. Instead of one, however, two wires are placed 16 inches from the ground, kept about 8 inches apart with a piece of wood. U-forms and horizontal cordons can then be alternated, with the U-form trained to one wire and the horizontal cordon to the other.

The training should start late in July when the young growth has reached the lower wire. The new growth, not yet woody, is bent to the left by twisting until a right angle is formed. It is tied to the wire in this position with raffia. The tip is pinched back and only one bud is left beyond the bend. This pinching forces the bud just below the wire to grow and to form the right arm of the tree. During the rest of the season both sides will produce from 9 to 18 inches of new growth. This new growth should be kept tied to the wire.

The U-form is treated in exactly the same way, but after the horizontal growth on both sides has reached a length of about 10 inches, this growth is bent by twisting it in a vertical position and tying it to a lath reaching from the ground to the upper wire. The distance between the two vertical branches should be 16 inches. It is best to cover places where bending and twisting are necessary with grafting wax or paraffin.



*Condensed from the New York State Agricultural Experiment Station Bulletin No. 773 by Karl D. Brase.

†In the three drawings, A indicates wire; B, vertical supports, and C, diagonal or horizontal supports.

Fan shapes for fences (*see below*)

(*Continued from page* 32)

As foliage becomes compact, thinning out must also be regularly given attention.

Fruit must likewise be thinned; for the best crop, bearing spurs should be spaced 3 to 5 inches apart. All trees, young ones in particular, should be discouraged from bearing heavily. Thinning of fruit helps to prevent a tree from acquiring a biennial habit.

At any time of the year, all diseased, broken, or dead branches should be removed. The crown should be thinned out when it becomes too dense, in order to give remaining branches better exposure to the sun. Weaker branches should always be cut whenever space for light is attained by removing them. The less desirable of two crossing branches or of two closely parallel branches should also be pruned away. Since no long stubs should be left, the cut is made just above a side branch or bud. Cuts exceeding 1½ inches in diameter need to be sealed with antiseptic paint.

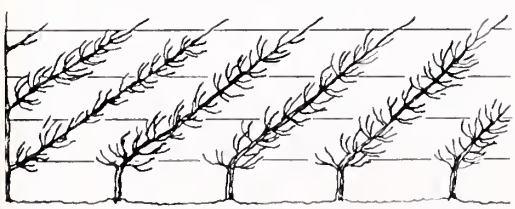
During both summer and winter pruning, the artistic shaping of the tree is of importance. Anything meant to be symmetrical should be perfectly symmetrical. The outline should be well proportioned and the crown should be of equal density throughout. Theoretically, main branches forming the skeleton should be of equal stoutness. Leaders should be kept even. If one branch becomes too long, it may be cut to a bud or it may, temporarily, be bent downward to allow its counterpart to catch up. The tip receives less sap when lowered, thus it grows less fast; when its mate has reached an equal length, the bent tip should be again raised. The leaders of fan-shaped trees should be cut throughout the summer in order to keep the outline that of a fan.

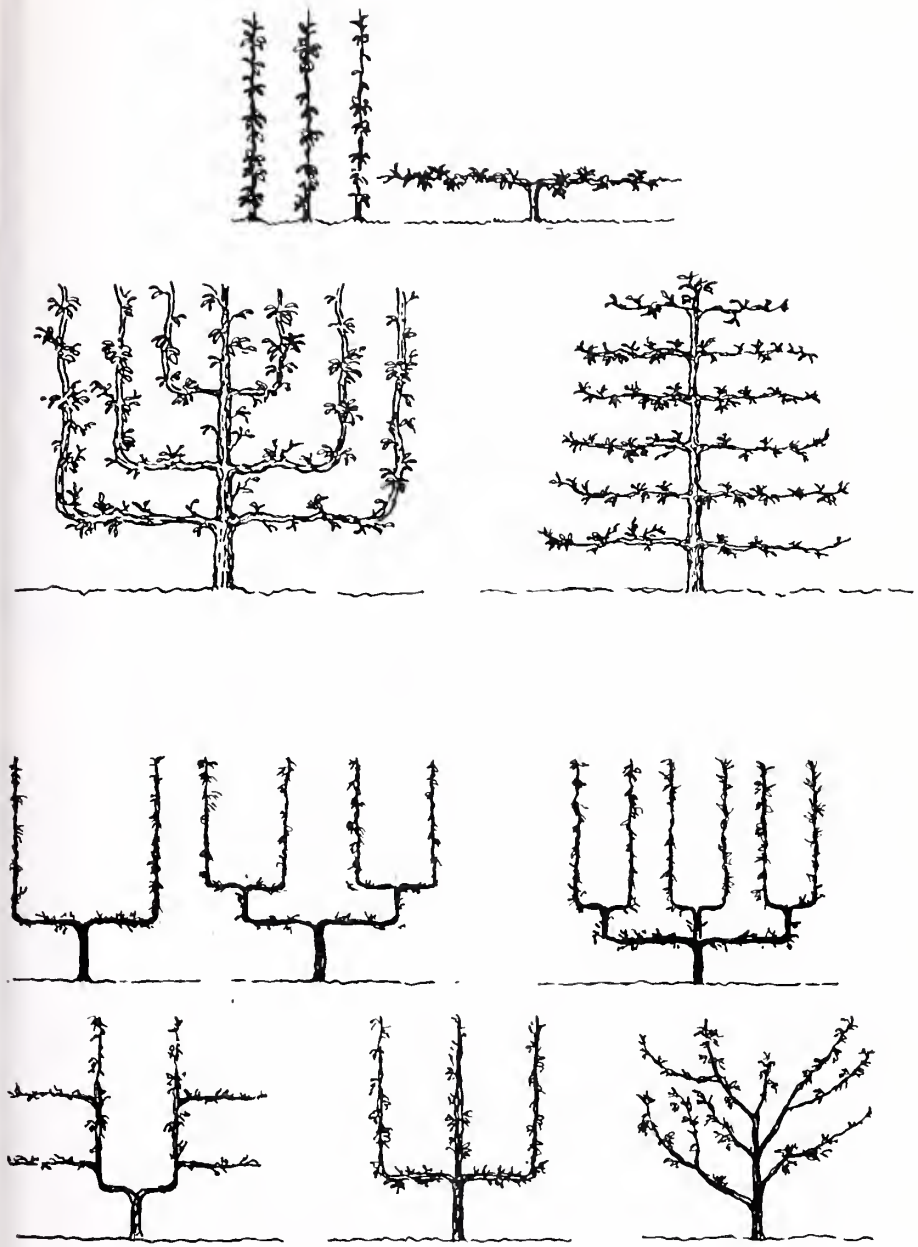
In areas where the amount of intensity of the sun produces a very fast rate of growth, pruning may be advisable as often as once a week. Where the sun is exceptionally hot, it may be necessary to leave enough foliage to shade the fruit so that it will not burn. In such climates it is best to give the tree a less hot exposure. If a light-colored wall produces too much heat, a temporary expedient is the planting of a green vine behind a young espalier (an older tree will produce enough foliage to shade itself). But this mottled background will to some extent spoil the effect of a strict pattern. Too much shade will of course diminish fruiting and make limber, stringy growth; a rule of thumb is at least five hours a day of direct sunshine.

Where and for what purpose should espaliered fruits be planted? On the walls of the house, garage or other buildings; to cover a bare wall, to repeat the line of the chimney or follow a corner, to ornament a space between windows or under windows; on fences or walls or enclosures (as for a tennis court); to form a living fence. Also for shade, windbreak, protection, property boundary, screen, partition or decoration (as a Belgian fence); to cover an arbor or to form an arbor (as arching over a walk); to cover or form a shelter (as a gazebo or summerhouse). In addition, to follow the line of a path or walk as a border, or to outline a border or bed (especially with cordons); or to be a feature on terrace or in patio, in a tub or oblong container.

For those who wish to start with younger trees, a brief description of the training of the more usual forms follows. The various shapes that can be developed are shown in the drawings on the adjacent pages.

ESPALIERED FENCES. Three fan shapes (*at top*), the first branched low, the second high and thin, the third without a leader. *Below:* Oblique cordon (*left*). Belgian fence (*right*).

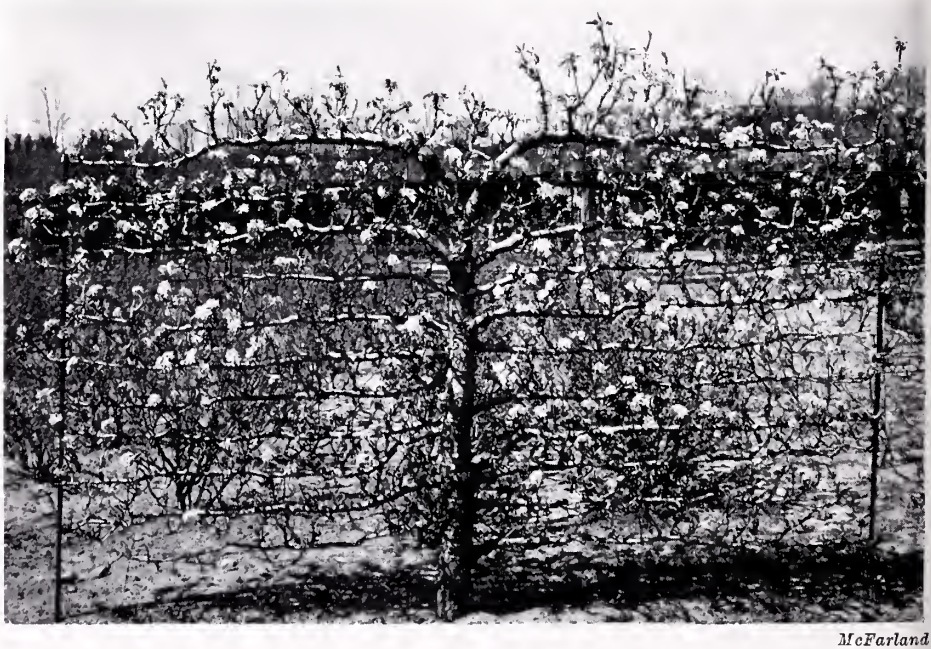




CORDONS AND ESPALIERS. *Top row:* Two types of cordons—vertical and horizontal. *Second row:* Espaliers, many-branched forms—gridiron and "espalier" (the style which goes by the group name). *Third row:* U-shapes—single, double, and triple. *Bottom row:* Other forms—double stem, three-grid, and random. (For fan shape and Verrier palmette in a four-palm design, see page 33; espalier fences, page 34.)

Genereux

Espaliered fruits as ornamental plants on house and property (*see opposite page*).



McFarland

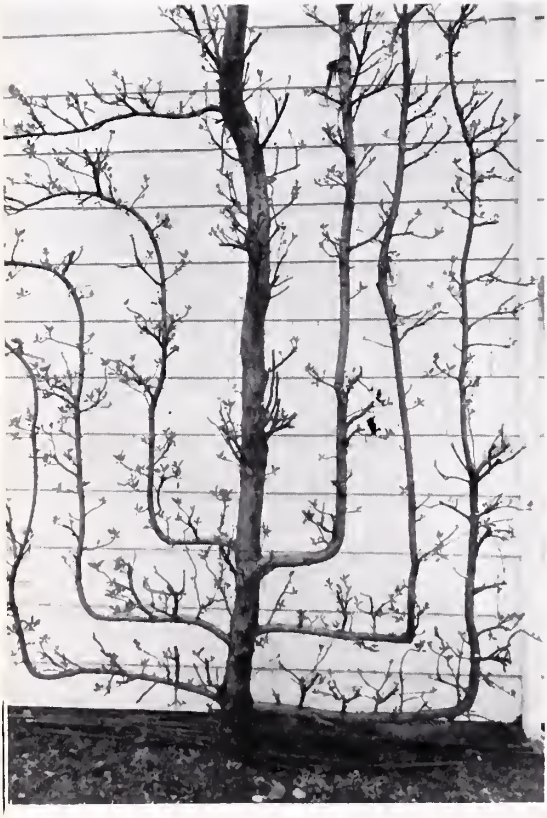
ESPALIERED FRUITS. Whether on houses or used as fences or forming the walls of a summerhouse, fruit trees are decorative when they are trained as espaliers. Pear trees ornament the outside wall of a house (*on the opposite page*), making an attractive approach across the paved terrace. Another pear is used as a free-standing fence, supported only by slender vertical rods and horizontal wires (*below, opposite*). In the West, a Burbank plum, shown here in full bloom (*right*), adorns the outside wall of a house. A peach is espaliered against a wooden fence (*below*) on the grounds of the Governor's Mansion at Colonial Williamsburg. Fine fruit can be expected from all these carefully trained trees.

Photo-Art

Roche

McFarland

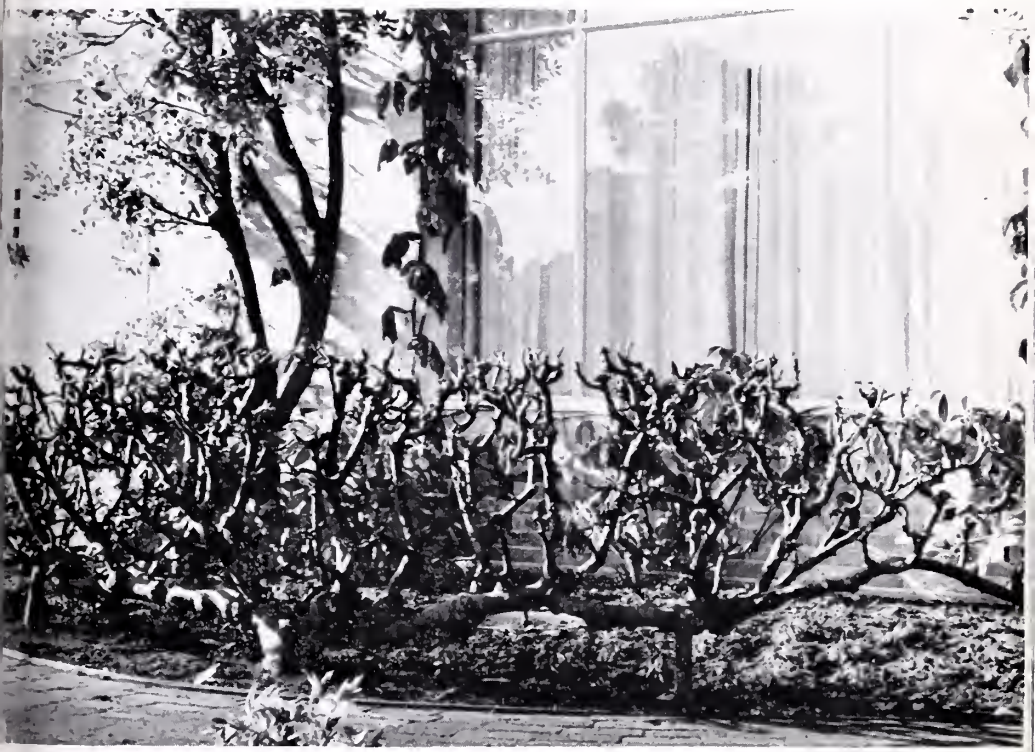
Roche



APPLES, ESPALIERED. Most striking in design among the trees shown here is the low semicircle developed on a Gravenstein apple at the Hillyer Brown home in California (*shown on opposite page*). As a free-standing fence, an espaliered apple in full bloom (*above*) has few rivals in beauty. The modified, asymmetrical design (*left*) has one side going up the wall of a house and one across, under a window. It has been attached and trained on heavy metal supports that stand out from the wall. The horizontally trained tree (*above, opposite page*) has the design called plain "espalier." It is shaped on heavy wires which are fastened to erect iron pipes at the ends.

Grossman

Apple trees in espalier forms (*see opposite page*).



J. Brown

Photo-Ar

SUMMERHOUSES. Espaliered fruit trees form the walls of these two summerhouses, the pear (*above*) letting in light and air and permitting a view across the garden, the apple (*below*) making a cool shaded shelter during midsummer's heat.

Genereux

GRAPES AND GOOSEBERRIES. Training of grapes in a form akin to espaliering can be done in a greenhouse (*opposite page*). A gooseberry-bush (*below, opposite*), makes an attractive and serviceable fan-shaped espalier. ⟿

McFarland photos

THE SCULPTURING OF SHRUBS

ALMOST every page of this handbook is devoted to propaganda for pruning. Even when plants sculptured by nature (page 7) are brought into captive surroundings, it will often be seen that nature has been subtly assisted by pruning shears that have accentuated, but not changed, the basic form.

Pruning is done for two main reasons: to foster the health of a plant and to improve its appearance. The former requires complete removal of old, dead, and decrepit wood; this means pruning from the inside of the tree or shrub. To aim at giving a plant a more pleasing form generally involves pruning and clipping from both inside and outside.

When an old overgrown shrub is to be artistically remodeled (in contrast with pruning for health), the newest wood is sometimes cut out from the inside, at its base, and the oldest wood is kept. This procedure, when clutter is cleared away, may reveal a fine old trunk that is worth displaying.

Pruning from the outside, while essential for topiary and other forms, is often unwisely resorted to when a plant should, instead, be discarded because of age or excessive size. Leaving a thick mass of foliage in the center should be resorted to only for artistic not for salvaging purposes, then only on plants which can thrive in such a condition. Pruning which is nothing more than reducing the circumference of a shrub is to be deplored.

In fact, shearing, clipping, or trimming is generally undesirable for the mere sake of neatness. However, if a design has been made or a plant has a shape to be maintained werein orderliness and compactness are attributes, then pruning from the outside is in order. Some examples will be seen in illustrations on the adjacent pages.

All topiary figures need periodic trimming from the outside, after the basic form has been worked out by drastic pruning from inside and out. Topiary requires artful execution as well as good design and a suitable place in the landscape. This is true of all sculpturing of plants accomplished by the hand of man, but especially when achieved by clipping on the outside to create a form.

TOPIARY GARDEN. Classical and whimsical designs are combined in the Grafton Mino garden in Santa Barbara. Eugenia and boxwood both are used for topiary here. Th ground pattern is made with euonymus.

Homan

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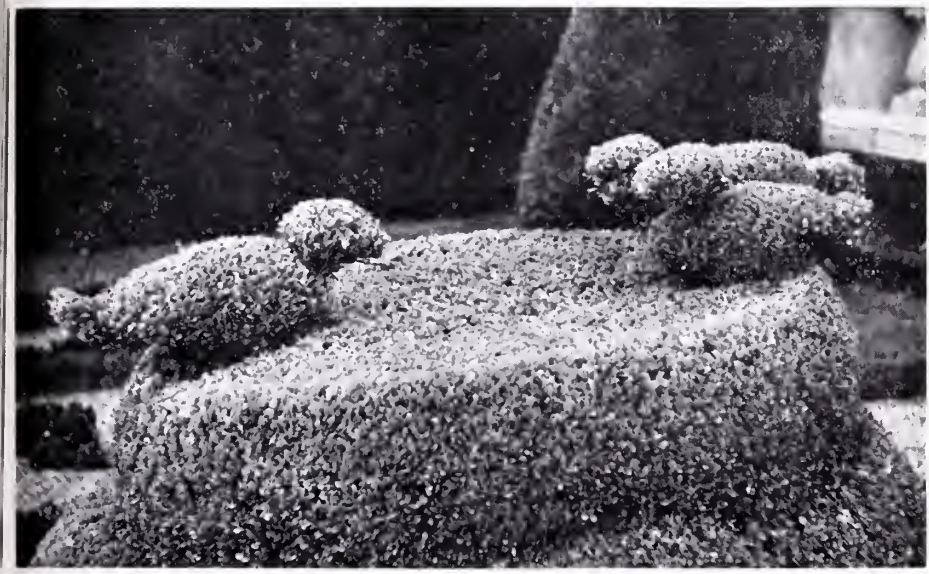
FEATURED DESIGNS. The plump bird (*above*) and the bird-bath group (*below*) are noteworthy specimens in the topiary garden shown opposite.



Homans

CREATING TOPIARY PIECES[1]

Neill Phillips

FOR many centuries, topiary work has gone up and down in the esteem of horticultural writers. But those who have scorned it have probably never tried it. Topiary is too fascinating an occupation not to command one's affection and respect.

In the United States topiary is now having a revival. My wife and I became seriously interested in it when we bought a house and garden in Virginia. Ten years of neglect of the garden's topiary

[1]Adapted, with permission, from an article by Admiral Phillips in the Bulletin of The Horticultural Society of New York, Inc., October and November 1960.

Church

Kell

POPULAR PATTERNS. Spiral and bird in boxwood (*left*), in a garden by Thomas D Church. Disks of the native juniper (*Juniperus scopulorum*) are topped by a peacoc (*right*) in the Denver garden of Jack Harenberg, landscape designer. The disks requir as precise pruning as the bird.

pieces had resulted in the loss of shape on many of them. Our task became the restoration of their intended forms and the creation of new pieces. Here are some of the things we learned under the guidance of our gardener, Roy Weeks.

A Lesson in Topiary

The best materials to use are boxwood, yew, hemlock, and privet. Boxwood is fairly easy to train, but is not always winter hardy in cold climates. Yew is hardy, beautiful of texture, and adaptable to training and clipping. Hemlock, being coarser, is less easily handled; but it is economical. Privet also is inexpensive; it grows fast and is easily shaped. It is not evergreen, however, and its texture is less pleasing than that of the other plants.

In planning a design we first try to decide what the plant in its natural form reminds us of. Then, if practical, w build our design around that concept Sometimes several plants are combine into a single creation—four for a four legged animal, two for a bird, a separat shrub (preferably dug from a hedge) fo the spreading tail of a peacock, and s on.

The first pruning, once the design ha been determined, is a severe one, ofte giving only the rough outline of the fu ture form. It is apt to leave the plan discouragingly bare. Boxwood is gen erally pruned in early spring, before new growth has started. Yew and hemlock are generally pruned in late July o August. Topiary pruning should neve be done in late autumn or winter, a freezing weather may cause damage.

When a frame is required for training a plant to a complicated form, or for part of a figure, we make one of quarter-inch

soft steel rod, bent to the desired shape with a pipe wrench. This is placed inside the bush, and branches are tied to it, as required, with rawhide strips (available from a shoemaker or saddler).

All that is needed henceforth is continued clipping and tying; after a couple of years, not much more tying. Clipping, however, is done every year in order to maintain a clean outline and refine the form. Once annually is enough for a close clipping and pruning, done at the same time of year as the original shaping.

An additional light clipping in summer will prevent shagginess. On boxwood, however, hot-weather trimming should be avoided, for the leaf edges then are likely to turn rusty.

Feeding, mulching, and watering are especially important for topiary, in order to keep new growth coming along. We have developed our own schedule.[2]

Unless ample water is available, topiary should not be attempted. Moisture is essential throughout long hot summers. Again in fall, the roots should be well soaked before cold weather arrives. And if a piece of topiary has been transplanted, it will need extra water for a full year.

Since topiary pieces frequently are transplanted, root-pruning is advisable at the time of the initial shaping. This not only lessens the shock of later moving, but also sometimes speeds up foliage growth.

Before transplanting (which we never do in freezing weather or in summer's dry heat) we spray the foliage with a commercial preparation to reduce transpiration. The root-ball and its surrounding soil are wrapped in burlap, and if the plant is to be transported in an open vehicle, the foliage is further protected with burlap. Boxwood often needs a latticework to give partial shade for a year after it has been transplanted.

Noble

PODOCARPUS GLOBE. In a Jacksonville, Florida, garden, this podocarpus or southern yew has been trained as a standard, then trimmed into a rounded dome.

Mock Topiary

We have devised a fast-growing imitation topiary which is surprisingly satisfactory in appearance. Building a three-dimensional form with hardware cloth we fill it with sphagnum moss to hold moisture, then plant creeping euonymus (*Euonymus radicans* var. *minimus*) all around it. Within a year or so there will be a dense green mat completely covering the sphagnum. This can be clipped to maintain a neat outline. The entire unit can be planted in the garden or it can be tubbed. The euonymus is hardy, disease resistant, and tolerant of either sun or shade.

[2]This schedule gives good results in our Virginia soil:

Steamed bonemeal

Early Jan. (wait for a thaw): boxwood and other plants in the ground—1 pound for each 3 feet of height

Early Feb.: boxwood and other plants in tubs—1 quart to each tub

Mid-Sept.: 1 quart to each tub

Blood meal

Early April: plants in the ground—1 pound for each 3 feet of height; 1 quart for each tub

Mulch of manure

Early Nov.: chicken manure (rotted) 2 inches, or if not obtainable, rotted stable or barn manure, 4 inches for all plants except those established in the ground; mulch to be raked off in 3 or 4 months

Mulch of buckwheat hulls or crumbled peat

Early Jan. or Feb.: after removing manure mulch and giving bonemeal, spread 2 inches and maintain through hot weather

SHAPED PLANTS IN HAWAII

Horace F. Clay

IN the predominantly informal gardens of Hawaii there is very little of the traditional type of topiary work. In gardens on all of the islands, however, one encounters pruning that is being practiced as an art.

There are handsome trimmed hedges of mock-orange (*Murraya exotica*), panax (*Polyscias,* or *Nothopanax, guilfoylei*), and ironwood (*Casuarina equisetifolia*). Carefully trained bonsai are tended by hundreds of garden lovers throughout Hawaii (both tropical and subtropical plants of many types are used by Island bonsai experts). In addition, reminiscent of gardens in the Far East, one can find many examples of specially pruned specimen trees and shrubs. (*Niwa gi* is the name of this Japanese art of pruning.)

In keeping with the modern trend toward oriental architecture and furnishings, many Hawaiian gardens are designed along traditional Chinese or Japanese lines. The average-sized home in Hawaii is located on property which is from 7,500 to 10,000 square feet in size. Thus, the garden area is small, and the proper scale in plant materials must be maintained. Very pleasing effects have been worked out by using smaller-growing trees and shrubs, and by pruning them judiciously.

The strawberry guava (*Psidium cattleianum*), with its dark green glossy leaves and juicy edible red fruit, is one of the most popular small trees. The smooth trunk is accented by careful pruning and thinning of all branches. Particular emphasis is placed upon maintaining a picturesque appearance, both in trunk line and in arrangement of side branches.

Surinam cherry (*Eugenia uniflora*), the paperbark tree (*Melaleuca leucadendra*), and vitex (*Vitex trifolia*) are other trees which are handled in this same way.

HAWAIIAN SCENE. Strawberry guavas in a Honolulu garden have been pruned to stand in interesting silhouette against the distant background. (Sketch from author photo.)

Similar pruning is often practiced on another plant known as mock-orange (*Pittosporum tobira*), and on the tecoma-tree (*Tabebuia pallida*). The Chinese banyan (*Ficus retusa*) lends itself very well to this specialized pruning technique.

The first-mentioned mock-orange (*Murraya exotica*) is frequently pruned into rounded mounds which remind one of the gardens of Japan that are accented by neatly clipped specimen plants. Plumbago (*Plumbago capensis*) and the Indian hawthorn (*Raphiolepis indica*) are other shrubs which are also pruned in rounded shapes.

The geometry-tree (*Bucida buceras*), with its odd zigzag branchlets, requires only a minimum of pruning to give a very oriental effect to a garden. By judicious removal of just a few branches, one can make an already interesting tree into a conversation piece.

Pruning is often aimed at making shrubs and trees asymmetrical. Such hidden beauty, even though man-made, is a true manifestation of gardening art.

PLANTS FOR CLIPPING INTO SHAPES

A selected list

For Accenting Natural Form

Buxus sempervirens, boxwood
Carpinus caroliniana and *C. betulus*, hornbeam
Catalpa bignonioides var. *nana*, weeping catalpa (when grafted high)
Ceratonia siliqua, St. John's-bread, carob-tree*
Chamaecyparis in variety, false-cypress
Cinnamomum camphora, camphor*
Crataegus in variety, hawthorns
Cryptomeria in variety
Cupressus in variety, cypress
Eucalyptus ficifolia, flowering eucalyptus*
Eugenia paniculata, Australian brush-cherry*
Ficus retusa, Chinese banyan*
*Hoheria populnea**
Ilex cornuta var. *burfordi*, Burford's holly
I. crenata var. *helleri*
Juniperus in variety, juniper, red-cedar
Laurus nobilis, sweet bay, laurel*
*Persea indica**
Picea in variety, spruce
Platanus acerifolia, London plane
Podocarpus macrophyllus var. *maki**
Prunus lusitanica, Portugal laurel*
Santolina chamaecyparissus, lavender-cotton
Tilia species, linden, basswood
Tsuga in variety, hemlock

For Clipping in Tiers

Acer palmatum, Japanese maple
Azalea in variety
Buxus in variety, boxwood
*Cocculus laurifolius**
Coprosma baueri, mirror-plant*
Corynocarpus laevigata, New Zealand laurel*
Cotoneaster in variety
Eugenia paniculata, Australian brush-cherry*
Euonymus alatus, winged euonymus
Ilex crenata and varieties
Ligustrum lucidum, Texas privet*
*Loropetalum chinense**
Maytenus boaria, mayten*
Phyllostachys aurea, *P. niger*, bamboo*
Pinus densiflora, Japanese red pine
P. thunbergi, Japanese black pine
Pittosporum (especially *P. tobira*)*
Podocarpus macrophyllus, southern yew
Prunus laurocerasus, cherry-laurel*
Psidium cattleianum, strawberry guava*
Pyracantha coccinea, firethorn
Tsuga canadensis, hemlock
Ulmus parvifolia, Chinese elm

For Topiary Work

Buxus in variety, boxwood
Euonymus fortunei var. *minimus*, winter-creeper
Juniperus in variety, juniper
Ligustrum in variety, privet
Myrsine africana, African box*
Taxus in variety, yew
Thuja in variety, arborvitae

*Starred plants are suitable for year-round culture only in mild climates.

PAD PRUNING. This Japanese style, also called "peony" or "pancake" pruning, is sometimes used for the effect of "snow blossoms" on the branches.

J. Brown

Meth

CLIPPING IN TUFTS. Podocarpus with a "poodle cut." This unusual style of pruning provides a curious decorative note from the outside and gives a vista from within.

Dustan

PATTERN WITH PLANTS. In this château garden in southern France, the diamond-shaped design in the foreground is achieved with low-trimmed lavender-cotton (*Santolina chamaecyparissus*) alternating with pebbles.

CONTAINER-GROWN PLANTS IN VARIED FORMS

THE TRAINING of various kinds of plants to be used for individual display, whether in garden, greenhouse, or house, is described by specialists on the following pages. While these are all assumed to be in containers, the same general rules for training would apply to plants in the open ground.

Many plants that are grown in containers need storage space for the dormant season. In mild climates strong growers that look attractive all year round may be left on display. Or, an outdoor spot can be used for storage, with perhaps the addition of a light shelter. Where there is a greenhouse, the storage problem for tender plants is simplified and, fortunately, greenhouses are becoming less of a luxury than they used to be.

From a greenhouse where a bonsai or other choice trained plant has been developing, a medium-sized container can readily be carried into the house for the enjoyment of guests. But plants in large tubs create special problems if they are to be moved either for shelter or display.

In one city home in San Francisco, the owner puts wheels on some of the large containers. For a party she brings one or two of her finest flowering shrubs into the house. (One is a standard weeping white fuchsia, lovely in a corner against a Shoji screen.) Even specimens that have been grown in containers out-of-doors can be handled in this manner.

In a community where true horticultural enthusiasts are numerous, it might be feasible to have a joint venture for handling large tubbed plants. A combination growing, storing, hospitalizing building might take a bit of organization, a clever system for moving, and a complicated set-up for allocating costs, but it could be an exciting project.

Plants in small, shallow containers in which there are no drainage holes are generally given gravel and charcoal as a bottom layer. On top of this, a house-plant mix that contains fir bark, ground charcoal, Styrofoam, peat or sphagnum, and a slow-acting fertilizer, with sometimes a little soil, too, should keep the plants in good condition. The mix should be tested at finger depth on a regular schedule, as a guide to watering. Just enough water should be given to keep it damp but not wet.

ENTRANCE ACCENTS. Young plants of leptospermum, an Australian shrub in the myr family, trained to tree, or standard, form for the entrance to a walled property in Hil borough, California.

Hom

Grossman

PEN PATTERN. This cutleaf Japanese maple in a large glazed pot has been trained nd pruned to reveal a pleasing design in trunk and branches. The resulting sparseness of oliage gives delicate shadows of individual leaves on the terrace pavement. (Compare the npruned Japanese maples on page 8.) For another container-grown tree pruned to reveal ıe trunk and to leave irregular spaces between the branches, note the cover photograph of podocarpus.

TRAINING PLANTS ON FRAMES

Mrs. Sidney Keith

Hugelmeyer

IVY BIRD. Not a feather to ruffle on this bird of ivy trained on a metal frame.

PLANTS trained on simple forms, such as arches or balls or cones or umbrellas, are not difficult of achievement if one has a bit of creative instinct. They make charming gifts. The more elaborate forms—birds and musical instruments and the like—are more of a challenge to one's ingenuity. Once completed, they are unfailing as conversation pieces.

While one can buy potted plants already trained to a design, as well as containers with a form inserted and a plant already started, let us assume that one wishes to make one's own creation from the start. Containers with bare forms in them are available, but one can also make one's own mold on which to train the plant.

After the container and the plant ha been selected, and the design has be determined, the next step is to build t form. Only one method will be describe

Take a roll of aluminum wire, No. Cut off an ample length for the ultima size, and roll it in reverse to get the cur out of it. Now with thumb and finge mold it into the size and shape desir to form an outline of the design. each end of the molded outline, leave (attach) a straight piece of wire to rea to the bottom of the container. The wire "stakes" are to anchor the fra in the container. After the plant h been put in place, these stakes should as close as possible to the position of t plant's one or more stems. The en

hich are to be buried in the soil can e turned up at right angles to make ie form more steady. While construct- ig an intricate form which requires at- aching additional pieces of wire to the rame, the stakes should be inserted in arth or a Styrofoam slab to hold the rame steady while the additional pieces re being attached. Angles are thus more asily turned and ultimate imbalance can e better avoided.

If the form is to be plaque-like, the rame can be constructed with one piece f wire. If the form is to be complicated r three-dimensional, more pieces of wire ill now be added to the first, tied to- ether with thin copper wire.[1] Thinner auge wire may be used for subsidiary ortions of the form. Extra wires afford mple anchorage for future runners. If art of the form should be heavy enough o tend to topple the structure, a prop o this projecting part may be made with heavy forked wire, but it must be mold- d so that it is hidden and its "stake" hould enter the earth close to one of the ain "stakes."[2]

Completed frames should be painted the color of the stem of the plant to be used. The existence of the frame should be camouflaged so that it will not be visible when its clothing has grown, even when this is trimmed close to preserve the shape. When figuring ultimate size in proportion to container or to the space the sculpture is to fill (such as a stand in the house or a niche in a flower show) allow at least an inch—or better, an inch and a half—for growth of the foliage beyond the frame's measurements.

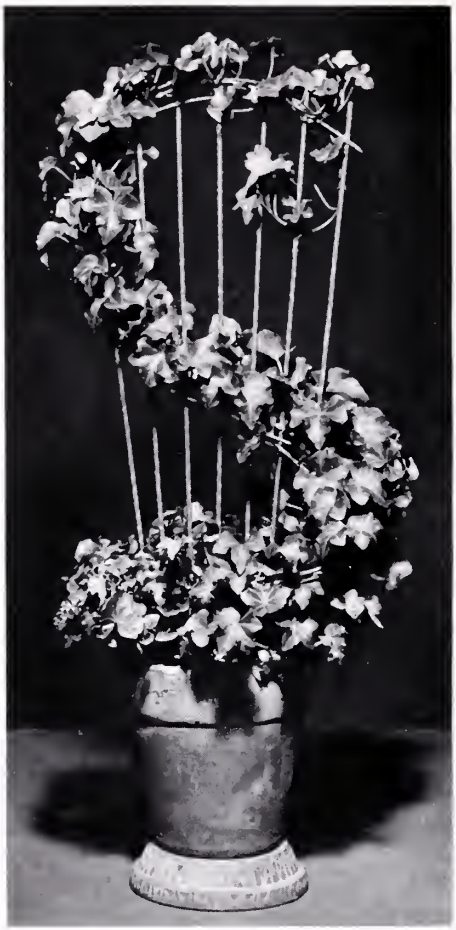
Now to clothe the form. A first consideration is the health of the plant. The most advantageous conditions should therefore be provided for its growth. Holding the frame in place in the container, place in it adequate drainage material and partially fill it with excellent potting soil, set the root ball of the plant, preferably large enough to have already grown several fairly good stems, in strategic position and pack potting mix around the ball, filling the crevices with care especially when the container is a decorative one. Water with addition of a

[1]Some people use solder.

[2]*Editor's note:* Other methods of making forms include the use of chicken wire or uilding materials. Sphagnum may be used as a padding or filler, though there is a school f thought that sphagnum causes stems to elongate with less compact foliage. For appropriate kinds of ivy and other plants suitable for training on forms see page 63.

)N WIRE ARCHES. Mint (*left*) and rosemary (*right*) are grown in shallow bowls and rained on circles of wire at the Merryvale garden shop in San Francisco. Meyer lemons nd cherry tomatoes add to the decorative note. A hybrid clematis (*center*) has been similarly trained as a terrace ornament in a garden in Hillsborough, California.

J. Brown *Homans* *J. Brown*



Hugelmeyer

PRIZE-WINNER. This gracefully curved harp, like the ivy bird (page 52), brought Mrs. Keith an award at the New York International Flower Show.

soluble fertilizer so the mix is evenly saturated. Now choose which stems should be trained in which directions. Run the strands straight on the wires, *not* twisting them around the wires or making loops. Tie frequently and securely—yet lightly—between the nodes; do not strangle circulation. Some ties may be cut and removed later as the stems mold to the form. Use florist string; double when extra strength is needed, split when mere guidance is that is needed. Tie closely up from bottom, for there must be no gap betw stem and wire near the soil.

As the stems grow, continue to them straight on the wires, except a loop to facilitate a turn. W a big turn must be made, arch the st loosely and leave it loose for ten da tightening it gradually; otherwise stem may crack. Tie the tips up loos while working in order to guide the ste along the wire without a dangling e Tie often as the plant grows so that t do not start off in the wrong directio If leaves turn in opposite directions th may be gently twisted and tied tempor ily with split string. The finished lo should be flat and smooth and with a p tern something like the scales of a fi If one is designing a bird, for examp its feathers should not be ruffled.

Ivy is the most popular material a probably the most successful (see illu trations, pages 24-25). Since the sma leaved kinds vary in habit and rate growth, a type should be selected accor ing to the size and kind of object to portrayed.

This training is not done in a da Do not attempt it unless the idea is i triguing enough to aim for perfection.

When sculpturing is completed, t work is still far from finished. Th masterpiece must be constantly groome No sixteenth of an inch of woody ste must be allowed to grow beyond the for no foliage must be marred, no dead dying leaf must remain, even aerial roo should be removed. Embroidery scisso and long tweezers are the tools. Spra ing leaves is not sufficient to keep folia immaculate, although regular spraying advisable for health as well as cleanline When "on show" each leaf will look i best if it has been polished with a sm cotton swab on a stick.

To train a plant on a form, consta attention is important, but imaginati and patience are essential.

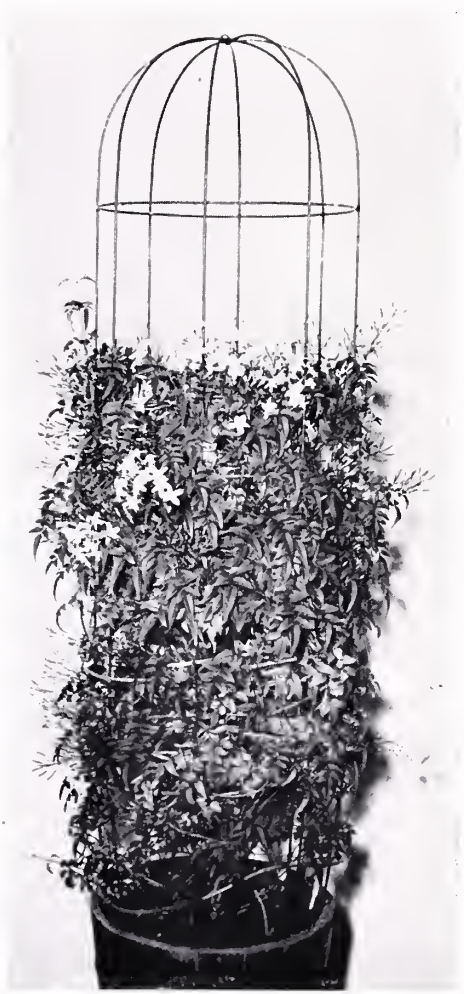
HOUSE PLANTS ON TRELLISES

Mrs. Laurence Laird Davis

SOME of the small climbing, creeping, twining, or scandent plants that are grown in containers will show their characteristics to better advantage if they are trained. Besides regulation trellises, bark slabs or composition poles and various forms or frames may also be used to induce production of an interesting line or shape.

Frames may be made with ordinary wire, chicken wire, or hardware cloth. About the simplest form is the cone, which can be made either open or solid. The open cone has three or more wires starting from the rim of the pot and meeting at the top, a plant growing up each and trimmed to remain close to each. When three wires are used this form is often called a triangle. The solid cone may be built in the same way but the plant is then allowed to make side shoots to fill the spaces between; it may or may not be filled with sphagnum moss. Cones may be of any proportions, from tall and slender to low and flat.

Other forms to be made with wire are balls or globes (either with or without a stem, and the ball either completely covered or its frame merely traced with stems), also spirals and arches of various proportions.[1] Several smaller-leaved climbers (see accompanying list) can be trained on such forms. Members of the *Cissus* group, including the kangaroo-vine (*C. antarctica*), begonia-tree-vine (*C. discolor*), and grape-ivy (*C. rhombifolia*), are excellent for training. *Peperomia scandens* and, of course, many kinds of ivy are also suitable. There are so many kinds of ivy that only a choice few are mentioned. (See the following page.)



Longwood

TRAINING PROCESS. Jasmine (*Jasminum polyanthum*) is here being made to conform to a wire frame that is embedded in a large pot. This is a conservatory specimen at Longwood Gardens.

[1] *Editor's note:* The open-work wire strips 2–4 inches wide which are used to reinforce building materials are excellent for forming arches. Two arches of different heights can be made in the same plane, or a four-sided cage can be created by using two strips of equal length and sticking their ends in the container 90° apart. A piece of driftwood, especially one with slender branches, also makes an interesting trellis for house plants.

English Ivy Varieties

'Maple Queen'—fresh green with pale veins; branching freely but the habit even and constrained; good keeping quality.

'Pin Cushion'—one of the tiniest; compact and sturdy; susceptible to red spider (other ivies and house plants subject also).

'Ideal'— a little darker, smaller, denser than 'Maple Queen'; vigorous.

'Gold Heart'—neat, pointed 3- to 5-lobed leathery leaves with appealing variegation and reddish stems; rapid grower.

'Gold Dust'—speckled leaves (some people feel it looks diseased).

Trellises of several shapes for house plants may be built of wire, of wood, or of bamboo. (The wire and wood are more attractive if painted; the bamboo should be shellacked.) The design of the frames can be similar to those used for espaliered trees and shrubs in the garden and can have, besides, variations as the imagination directs. Three suggestions are pictured here.

Plants with colorful foliage are excellent subjects for training on frames of this sort. Some of the tender species which bloom on trailing stems are also suitable. Here are only a few:

Colorfully-Leaved Plants

Coleus in variety—free branching, f growing; pinch back and select shoots save.

Iresine herbsti 'Acuminata' (Joseph's co —malleable, free branching; shar pointed leaves of green, deep red a crimson.

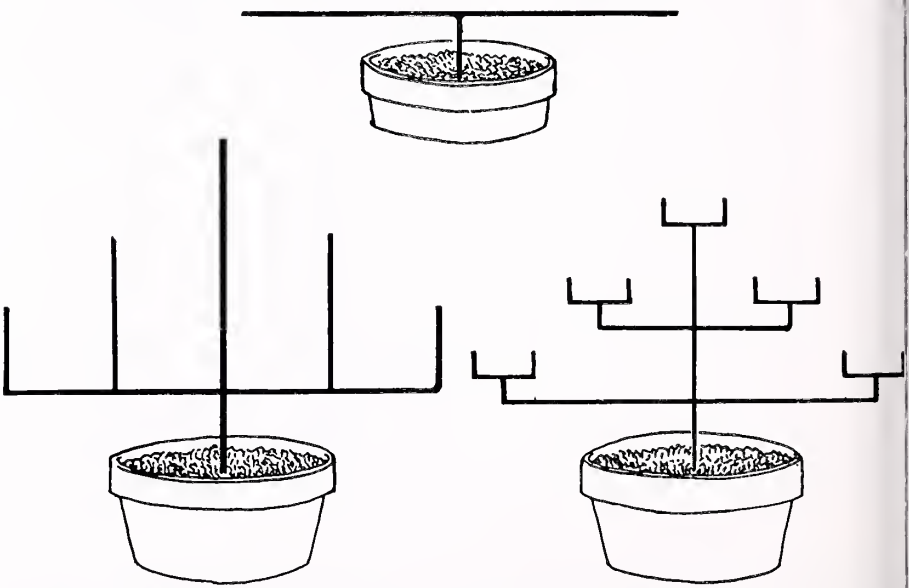
Pellionia pulchra—fleshy creeper which hu the support; pinkish stems, underleaf p purple on gray, upper surface gray green with network of blackish or bro ish veins; good for a horizontal cord type trellis.

Pilea cadierei (aluminum plant)—uprig form, striped leaves. Other species *Pilea* are also good.

Euonymus media-pictus — malleable, f branching; waxy oval leaves with fre green margins, golden yellow in the c ter and down the petiole and stem.

Cyrtanthus—fleshy trailer, which may be l up a support and allowed to cascade the top; brilliant flowers.

Many other species which are suitab for training in containers may be fou in "Exotica" by Alfred Byrd Graf, pu lished by Julius Roehrs Company, Rut erford, New Jersey.



POTTED ESPALIERS. Three suggested designs for training container-grown plants espalier form.

Standard or Tree-Form Plants

CAMELLIAS

Toichi Domoto

IN SELECTING a camellia variety for a standard, you may take any plant of your choice; but it should be remembered that strong, compact-growing types are to be preferred.[1] Culture of the plants is the same as for the bush form.

Method from a Cutting-grown Plant

Choose a strong plant with a leader (central main stem) that has not been pinched to induce bushiness. Keep the shoot tied to a stake to keep it growing upright. The lateral branches are not cut off completely, but kept pinched in order to force the growth into the main stem. The laterals will also help the main stem to thicken faster than it would if the stem were "skinned." Time required is three to four years to get the desired height of three to four feet. (This is starting from a plant in a one-gallon container.)

After the main stem reaches the desired height, top it. About twice a year, as lateral branches develop, prune them to form an evenly balanced branch system. The formation of flower buds is sacrificed at first in order to grow a compact, rounded head.

The lateral branches below the top should be pruned off the second year after the main branches are started.

Method from a Grafted Plant

We prefer a grafted (but not top-grafted) plant for a "tree" as it will generally produce a long straight stem in one season if the graft has been made on a strong established understock (five years or older). Shaping is the same as for the cutting-grown plant.

AZALEAS

John E. Edwards

TO DEVELOP standard or tree azaleas the following steps, beginning with selection of the plants, are required:

1. Select strong, well-rooted cuttings of the Southern or Indian hybrids,[2] single-stemmed and straight.
2. Pot in 5-inch clay pots with a mixture composed of 75 per cent peat and 25 per cent sharp sand of a quartz or granite base.
3. Fertilize often and lightly to keep growing vigorously. A regular fertilizer program should be maintained always.
4. As the stem grows, snap from it any side branches.
5. Stake well to keep the stem straight. (If one has a greenhouse, faster and straighter early growth can be induced.)
6. When the stem has reached a height of 40 to 44 inches, repot to a larger container, using the same mixture.
7. Stake well with a stake at least 48 inches tall to allow a 6-inch burial.
8. Determine the height that you want the standard to be (we head ours at 42 inches). Pinch out the tip and allow side branches to develop a symmetrical head.
9. As the side branches grow outward, pinch out the tip of each to encourage more branching and complete symmetry.
10. Never allow the plant either to get too dry or to remain too wet.

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[1] *Note:* Top-grafting on plants that have already made the desired height is not recommended as the balance in growth between the scion and stock is hard to maintain.

[2] While we use the Southern Indicas, certain of the Kurume and Rutherfordiana types can be used provided one selects really strong growing clones.

CASCADE CHRYSANTHEMUMS

Earl Kuklo

THE CASCADE is a limber-stemmed plant with all growth purposely developed on one side, to present a mass of color in a waterfall effect.

Caseades need a long growing season; therefore cuttings should be rooted as early as the season allows.[1] After a good root growth is established, place in 10- or 12-inch pots or redwood boxes. Pineh back the plant when about 12 inches high; but after this, do not pinch or "stop" the main top leader. Instead, pineh out the side shoots when 3 to 4 inches long; eontinue pinehing until about September 1.

Proper training with a wire trellis is the secret of cascades. A length of 10- or 12-gauge galvanized wire about 9 feet long is bent in half to form an elongated U; another pieee of wire goes lengthwise through the center of the U and is a taehed to the middle of the eurve; tw other pieees eross the U to divide t trellis into thirds.

Plaee the trellis vertieally in the p about 1 ineh away from the main ste plunge the free ends of the wire into so

About 6 inches above the top of the p bend the wire to a 45° angle from ver eal. Gently bend the plant over the wi and tie the leader stem to the center wi at intervals. Tie side growth along si wires and eontinue tying as the pla grows. Face the pot so that the tip the wire points north. Gradually be wire until, by mid-September, it is in horizontal position.

Then turn the pot so that the wi points direetly south; about this time t buds begin to form. Plaee pot in a hig position, to avoid flowers touching t ground, and continue to bend the wi gently downward so that when buds sho color it is in an almost vertieal positio

Caseades must be kept growing eo stantly. Keep them well watered a feed them once a week with a weak dil tion of Atlas fish emulsion fertilizer.

[1]At the Brooklyn Botanie Garden, cuttings are started in the greenhouse in Decembe Pinching back begins when the plants are 6 inches high, and repotting is done regular until the plants are in a 7- or 8-inch pot. A complete fertilizer is applied every other wee

FLORAL WATERFALL. Beginning stages in training caseade chrysanthemums, with ti at first pointing north. Heavy lines indicate where side shoots should be pinched off.

DWARF CITRUS IN TUBS

Floyd C. Dillon

THE ANCIENT European custom of growing tubbed citrus trees both for ornament and fruit is being revived with emphasis on growing the trees as espaliers. Through the use of dwarfing rootstocks developed at "Four Winds," citrus can now be grown in containers even in non-citrus climates.

Because the roots are dwarfing and do not have a taproot, these plants are more adaptable to container planting and espaliering than standard orchard trees. They grow less fast, less big, and less like a tree. Their fruit, however, is full-sized and true to variety name. Their low branching habit offers an excellent start for the espalier. A true dwarf citrus in a container is mobile; therefore it can be featured on the terrace or moved into the house as a year-round attraction.

Thirty varieties are produced by the "Four Winds" growers at Mission San Jose, California. While all can be espaliered, some are more advantageous for certain espalier situations. Rapidity of branch elongation, the size of foliage and fruit, even fruit color might be considered in the choice of a variety.

For most rapid branch elongation and faster coverage of large areas, varieties such as the Summer Navel orange, the Frost Nucellar Valencia orange, and the Lisbon or Nucellar Eureka lemon are an excellent choice. The Ponderosa lemon, with its immense fruit, could well be used as a conversation piece.

The opposite type, which might be classed as twiggy, includes the Eustis kumquat, the Kinnow or Clementine mandarin, the Dancy tangerine and the calamondin (*Citrus mitis*).

More average growth types are the Robertson Navel orange, the Shamoudi or Trovita orange, the Marsh Seedless grapefruit and the Sampson tangelo. The Pearss Seedless lime is quite rigid but espaliers well.

Open, pendulous branching varieties such as the Owari Satsuma and Kara mandarins, the Tarocco orange or the Minneola tangelo might be shaped by selecting the most interesting branches and pruning others to accentuate asymmetrical or pendulous forms.

Some of the dwarf citrus plants are also excellent as bonsai specimens. The Nagami kumquat is especially good.

Citrus espaliers may be grown in many sizes and shapes, from the formal cordon types to the most casual, vinelike effects. Whatever the design, a full-sized trellis should be provided for support. All growth not conforming to the design must be removed. While soft young growth may be pinched off with the fingers, older wood must be pruned off. The first stages of growth should fill out the lower part of the trellis. Once the bottom width is established, the tree will always fill in above it.

DECORATIVE AND USEFUL. Dwarf citrus trees, with their evergreen foliage, fragrant flowers, and tasty fruits, can be attractively espaliered in containers.

J. Brown

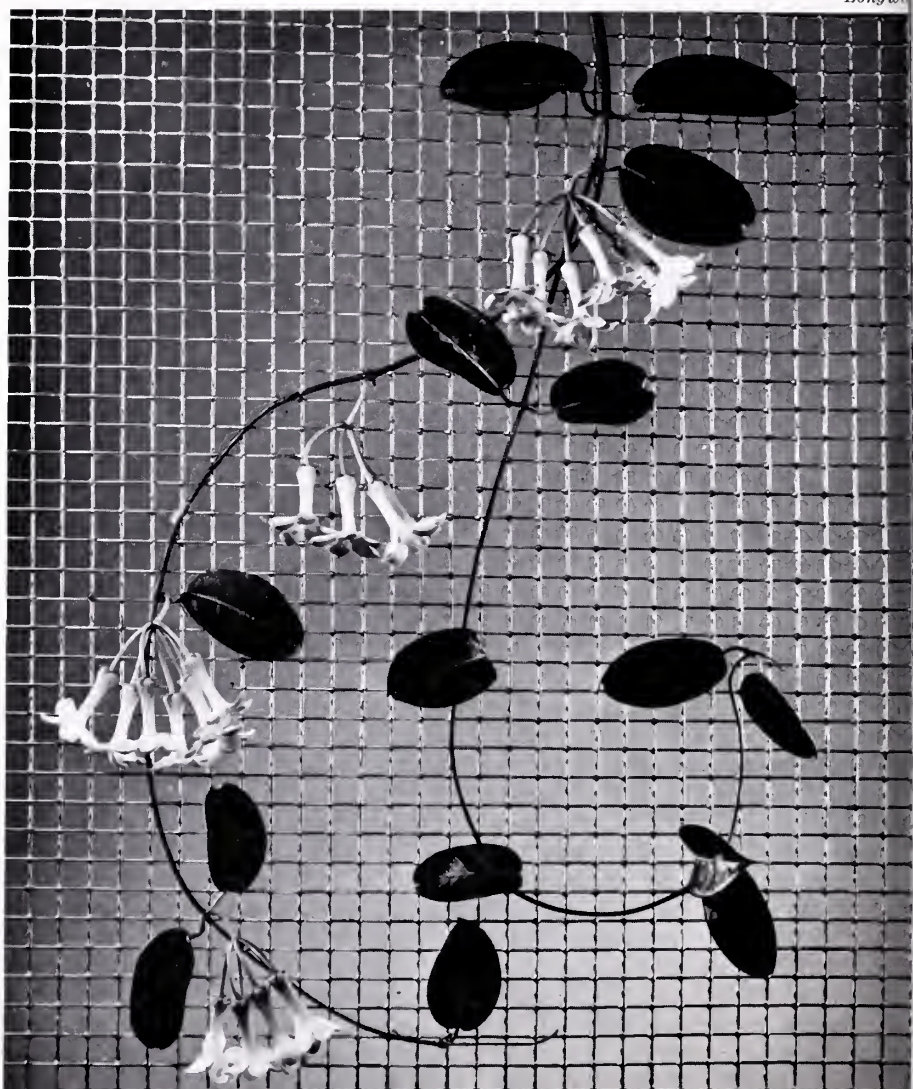
TRAINING VINES UNDER CONSERVATORY CONDITIONS

W. H. Hodge

THE TRAINING of vines under conservatory conditions follows the same principles used with such plants in the outdoor garden. At most, any differences that exist are related to the more limited space generally available indoors which makes it necessary to use greater care in keeping vines well within bounds. The use of special forms such as baske standards, poles, and domes—besid yielding variety of form for display enables one to utilize the limitations space more efficiently. Growing vines pots or tubs, as is generally done wh vines are trained on forms, also perm moving these plants easily for better d

FRAGRANT VINE. Madagascar jasmine (*Stephanotis floribunda*) at Longwood Garde

Longw



Longwood

TREE FORM. *Streptosolen jamesoni*, a semiscandent shrub of the Andes with orange-red flowers, trained as a five-foot standard.

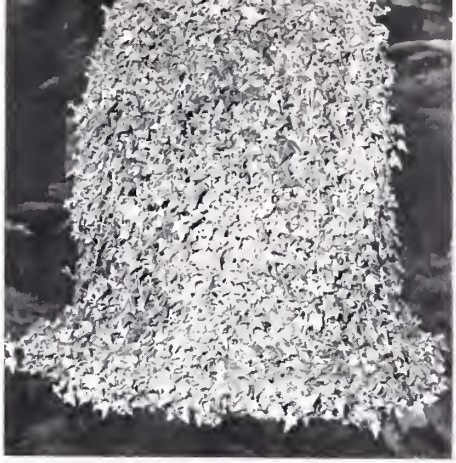
play or culture, including placing the subjects outdoors during favorable seasons.

The presence of pillars or walls in a conservatory makes it possible to grow ornamental foliage vines of various sorts, but those, like the creeping fig (*Ficus pumila*), which climb by means of adventitious roots, are particularly useful. This species may be kept close to its support by annual shearing of all lateral branches. Other vining figs (such as *Ficus sarmentosa* and *Ficus radicans*) as well as a number of tropical vine genera (philodendrons and similar aroids, hoyas, cissus, etc.) make interesting specimen plants when allowed to cover small poles set in pots. One of the most useful and lasting materials for such poles is sectioned tree-fern trunk.

Heavy wire, shaped into various trellis forms, such as fans and domes, is often used as a support for training ornamental vines grown primarily for their flowers. Besides the mobility of such plants grown in pots on low forms, the flowers are brought closer to eye level—which means greater enjoyment. Wire forms of this type may be built to varying sizes. Forms 5 feet high, placed in pots or tubs 12 inches in diameter or larger, are practical and effective for a number of vine types, but mostly for those with lithe twining stems such as showy mandevilla (*Mandevilla splendens*), yellow hibbertia (*Hibbertia volubilis*), various species of true jasmine (*Jasminum*), the flame pea (*Chorizema ilicifolium*), Confederate-

A TWINER TRAINED. *Hibbertia volubilis*, a yellow-flowered, evergreen twining shrub of Australia, kept under control on a frame in a large urn at Longwood Gardens.

Longwood



Longwood

IVY BELL. Suspended from the conservatory roof at Longwood Gardens is this large bell of English ivy in a hanging basket.

jasmine (*Trachelospermum jasminoides*), varieties of bougainvillea, the Argentine trumpet vine (*Clytostoma callistegioides*), Madagascar-jasmine (*Stephanotis floribunda*), and the like.

Vines grown on dome- or fan-shaped forms are simply tied to the uprights and cross pieces regularly as they grow until the whole dome is eventually covered. Subsequent handling depends usually on the growth habit of the particular vine involved. Those like mandevilla, with less compact growth and large flowers which are showy for long periods, should be permitted to grow in a more open fashion than more compact vines like *Stephanotis* or *Trachelospermum*. The latter are easily trained into attractive domes of greenery, which can be maintained as tub specimens for many years. Species with the habit of *Trachelospermum* are not pruned back annually since cuts would stimulate formation of a plethora of branchlets difficult to handle. Instead, new growth is regularly tied in after flowering; after four to five years, much old growth accumulates so the whole mass of a *Trachelospermum* dome must be taken down and the old stems thinned out drastically, after which the plant is retied onto its dome.

Woody vines grown in pots or tubs can also be readily trained into standards. In these all lateral growth is limited by judicious pruning, resulting in the production of a single upright stem 4 to feet tall, crowned by numerous later branches which are generally allowed radiate in umbrella form. Species wit naturally pendent branches or flow clusters are particularly effective as stan ards. Vines producing heavy wood stems such as wisteria, bougainvill and jasmine, are best suited to produ tion of sturdy standards, though wit suitable support any woody vine can so trained. Species like *Jasminu mesneyi* (*J. primulinum*) have the later top branches pruned back annually one bud or eye. Large tubbed wisteri standards, besides requiring annual pru ing of the stems, are also root-prune occasionally, usually every four to fi years or when retubbing is essential.

Vines like English ivy which have natural trailing habit may be considere as subjects for hanging baskets. Suc baskets are usually open-mesh wi frames in which a standard soil mix held by a liner of sphagnum moss.

QUARTER-CENTURY. This flower-lade star-jasmine (*Trachelospermum jasminoides* at Longwood has been grown on a five-fo wire dome in a tub for 25 years.

Longwoo

Longwood

PILLARED VINES. These are some of the many vines trained for decorative effect at Longwood Gardens: The juvenile form of the Japanese climbing fig (*Ficus sarmentosa*), with ivy-shaped leaves (*left*), trains itself into a living mosaic on a two-foot pole of Hawaiian tree-fern trunk. The Philippine clamshell hoya (*Hoya imbricata*) clings to a post made of wire mesh stuffed with moisture-holding osmunda fiber and sphagnum (*second*). The fragrant *Hoya laeunosa* (*third*) and a climbing fig with mottled leaves (*Ficus radicans* var. *variegata*), (*right*), grow effectively around lengths of tree-fern trunk. (See also page 55.)

PLANTS FOR TRAINING IN CONTAINERS

A selected list

Standards

Acer palmatum, **Japanese maple**
*Allamanda cathartica**
*Aucuba japonica**
Azalea in variety
Beloperone guttata, **shrimp-plant***
Bougainvillea, especially hybrids*
Bouvardia in variety*
Callistemon speciosus, **bottle-brush*** (also other species*)
Camellia in variety
Chrysanthemum frutescens, **marguerite***
Clerodendrum thomsoniae, **glorybower***
Cytisus in variety, **broom**
Dimorphotheca ecklonis, **Cape marigold***
Dodonaea viscosa, **hopseed bush***
Forsythia in variety
Fuchsia in variety*
Gardenia in variety*
Genista in variety, **broom***
Hedera hybrids, **ivy*** (grafted on *Fatshedera*)
Heliotropium arborescens, **heliotrope***
Hibiscus rosa-sinensis, **rose-of-China***
Hydrangea paniculata var. *grandiflora*, **peegee hydrangea**
*Lantana camara**
Jasminum mesnyi (*J. primulinum*), **primrose jasmine***
Leptospermum scoparium hybrids*
Mahonia lomariifolia (and other species)*
Pelargonium domesticum, **Lady Washington geranium***
P. hortorum, **bedding geranium***
Rhamnus alaternus, **buckthorn**

(*Concluded on inside back cover*)

*Starred plants are suitable for year-round outdoor culture only in mild climates.

Nol

Buhle

IN THAILAND. The S
amese (Thais) have bee
practicing topiary and a
lied arts for many cent
ries. The ancient clippe
tree in front of the roy
palace at Bangko
(*above*) is a tamarin
(*Tamarindus indicus*)

BONSAI. The Japanes
practice of training tre
as dwarfs, in ornamenta
containers (*left*), no
of wide interest i
the United States, r
quires greater skill tha
any other type of trai
ing. Directions for th
training of bonsai a
contained in the Brool
lyn Botanic Garden
Handbook, "Dwarf Po
ted Trees — Bonsai
Japan." Courses of popu
lar instruction in grov
ing and training bonsa
are given at the Botan
Garden each winter.

(*Continued from page 63*)

Ribes grossularia, **gooseberry**
Rosa in variety, including dwarf forms
Rosmarinus officinalis, especially 'Tuscany Blue', **rosemary***
Spiraea vanhouttei
*Streptosolen jamesoni**

Umbrella Forms

Clematis in variety
Doxantha unguis-cati (*Bignonia tweediana*), **cat's-claw vine***
Fuchsia (weeping kinds)*
Wisteria

Cascades

Azalea in variety
Chrysanthemum hybrids
Dodonaea viscosa var. *purpurea*, **purple hop-seed bush***
Forsythia intermedia, **golden-bells**
Halimiocistus (*Halimium* × *Cistus*)*
Hebe hulkiana, **veronica***
Jasminum floridum, *J. parkeri*, **jasmine***
Juniperus in variety
*Loropetalum chinense**
*Melaleuca wilsoni**
*Pileostegia viburnoides**
Rosmarinus forresti, **rosemary***
Teucrium fruticans, **germander***

Vines for Training on Forms[2]

Aeschynanthus pulchra, *A. tobbiana**
*Ceropegia bulbosa**
Cissus antarctica, **kangaroo-vine***
C. rhombifolia, **grape-ivy***
C. discolor, **begonia-tree vine***
Chorizema ilicifolium, **flame-pea***
Clematis montana, **Himalayan clematis** (and other species and varieties)
Clytostoma callistegioides, **Argentine trumpet-vine***
Ficus pumila var. *minima*, **climbing fig***
Gloriosa, **climbing lily***
Hedera helix in variety[3]
Hibbertia volubilis, **Guinea-gold vine***
Hoya carnosa, **wax-plant*** (and other species)
Hydrangea petiotaris, **climbing hydrangea**
Jasminum in variety, **jasmine***
*Mandevilla splendens**
Oxera pulchella, **royal climber***
Parthenocissus in variety
*Rhoicissus**
Rosa (dwarf climbers), **rose**
Scindapsus pictus, *S. aureus* (*Pothos*), **ivy-arum***
Stephanotis floribunda, **Madagascar jasmine***
Thunbergia atata, **Black-eyed-Susan vine***
Trachelospermum jasminoides, **Confederate jasmine***

Hanging Globes or Plaques

Davallia bullata, **squirrel's-foot fern*** (also other ferns)
Nepeta hederacea, **ground-ivy**
Oxalis in variety, **wood sorrel**
Saxifraga sarmentosa, **strawberry-geranium***
Succulents in variety (often mixed)*

Trees and Large Shrubs For Containers

Bucida buceras, **geometry-tree***
Casuarina equisetifolia, **ironwood***
Eugenia uniflora, **Surinam cherry***
Ficus retusa, **Chinese banyan***
Melaleuca leucadendra, **cajeput-tree***
Murraya paniculata (*M. exotica*), **mock-orange, orange-jessamine***
Psidium cattleianum, **strawberry guava***
Rhaphiolepis indica, **Indian hawthorn***
Tabebuia pallida, **tecoma-tree***
Vitex trifolia
*Pittosporum tobira**
*Plumbago capensis**
Polyscias (*Nothopanax*) *guilfoylei*, **panax***

Plants for Trellises

Camellia japonica
C. sasanqua
*Coleus rehneltianus**
Euonymus japonicus var. *medio-pictus*
*Fatshedera lizei**
Feijoa sellowiana, **pineapple-guava***
Fuchsia in variety*
Ilex 'San Jose,' *I. cornuta* var. *burfordi*, and others
Iresine herbsti var. *acuminata*, **pointed blood-leaf, Joseph's coat***
Malus in variety (dwarf forms), **apple**
Odontonema strictum, **firespike***
*Petilonia pulchra**
*Peperomia scandens**
Pilea cadierei, **aluminum-plant***
*Pittosporum tobira**
Plectranthus in variety*
Prunus in variety (dwarf forms)
Psidium cattleianum, **strawberry guava***
Pyrus in variety (dwarf forms), **pear**
Rhododendron fragrantissimum, **Himalayan rhododendron***
Rosmarinus in variety, **rosemary***
Sollya fusiformis, **Australian bluebell***
Swainsona galegifolia var. *albiflora**

[2]Vines recommended for training on poles include *Cissus* in variety,* *Ficus sarmentosa*,* *F. radicans*,* *Hoya* in variety,* *Philodendron* and other aroids;* as spirals: *Clematis* in variety, *Hardenbergia comptoniana*,* *Rosa* (climbing species), and *Soltya fusiformis* (*S. heterophylla*), the Australian bluebell.*

[3]Named ivies: Shamrock, Ripples (Curlylocks), Ideal, Fan, Ivy Lace, Petite, Sylvan Beauty, Needlepoint, Ace of Spades, Maple Queen, Gold Heart, Improved Glacier, Gold Dust, Pin-Cushion.

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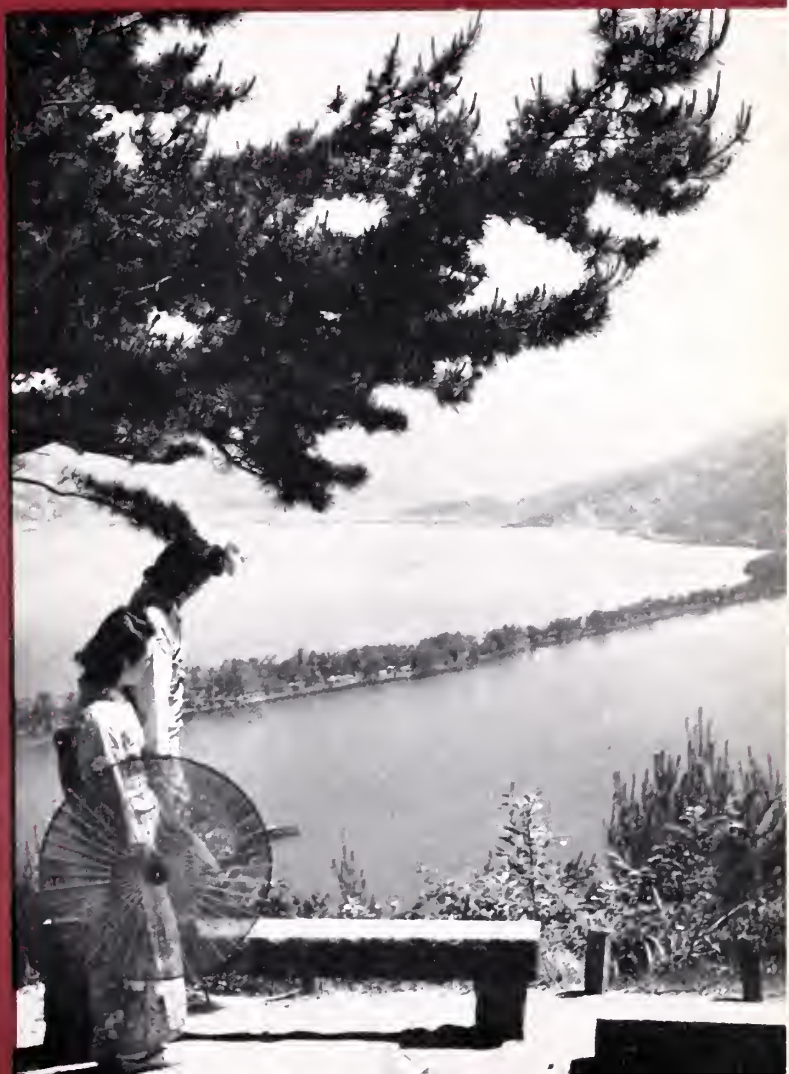

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NEW SERIES
7 No. 3

AMONG THE CONTRIBUTORS TO THIS ISSUE

Nobuichi Kagawa, for many years Landscape Gardener at Ritsurin Park, Takamats Japan.

Yuki Katsuno, since 1944 Headmistress of the Hosokawa school of Bonseki Tsudjido, Fujizawa-shi, near Yokohama, Japan.

Momoo Kitagawa, Contributor to the Asahi Evening News, Tokyo, Japan.

Peter K. Nelson, Instructor in Biology, Brooklyn College, and Associate Editor this issue of Plants & Gardens.

Takuma P. Tono, practicing landscape architect and Professor of Landscape Archite ture at Tokyo Agricultural University, Tokyo, Japan. A graduate of Hokkaic (Japan) and Cornell Universities, Professor Tono is on a short-term fellowsh at the Brooklyn Botanic Garden.

Kan Yashiroda, well known to readers as editor of the Handbook on Dwarfed Pott Trees, and in 1955 C. Stuart Gager Fellow at Brooklyn Botanic Garden. A on time student at Kew Gardens, England, Mr. Yashiroda maintains a famo Acclimatization Garden at his home in Tonosho-Kyoku, Kagawa-ken, Japa

PLANTS & GARDENS

Vol. 17 Autumn (November), 1961 No. 3

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Editorial

KAN YASHIRODA, *Guest Editor*

PETER K. NELSON, *Associate Editor*

TAKUMA P. TONO

and the Editorial Committee of the Brooklyn Botanic Garden

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Autumn 1961

Things Japanese continue to interest us here at the Botanic Garden, and we count it part of our job to interpret Japanese horticulture and gardening to English-speaking readers everywhere. As part of this program, we have had Takuma Paul Tono, landscape architect of Tokyo, with us this autumn on a short term fellowship. While here he has given several courses on the design and construction of Japanese gardens. About 150 people have taken these courses with enthusiasm.

Mr. Tono has also supervised the construction of a replica of the Stone Garden at the Ryoanji Temple in Kyoto, Japan. The original Ryoanji Temple Garden built by Buddhist monks five centuries ago is an abstract garden in which there are no plants. To compare it to traditional gardens of the Western world or to our 18-year-old Japanese Garden would be like comparing abstract paintings to traditional art. One writer remarks that viewers of the Ryoanji Garden "will sense complexity within simplicity. They will hear voices within silence. It is the garden that becomes truly living by resorting to the paradoxical."

The traditional hill-and-pond gardens of Japan date back at least 1,500 years. The dominating idea in such gardens is to create beautiful landscapes, generally more or less in miniature. With rocks, stone lanterns and waterfalls, the aim is to capture and perhaps even out-do nature, remembering always the importance of the gardenesque, the enchanting. Zen priests of the 12th and 13th centuries became skilled garden designers, and it was they who added rich philosophical concepts to gardening. Throughout the articles in this Handbook it is evident that the philosophy behind Japanese gardens is as important as the gardens themselves. To the Japanese the plum blossom symbolizes courage, the bamboo, perserverance; the pine tree typifies long life.

In the pages that follow, readers will discover such phrases as . . . "in quiet taste . . ." and "the effect of tranquility." "True beauty," they will learn, "can be discovered only by one who completes the incomplete." About a certain type of small garden, Editor Yashiroda remarks that "it is unlimited in only two dimensions . . . the open space above, and the imagination of the spectator."

We are fortunate in having Mr. Kan Yashiroda as Guest Editor of this Handbook. He lives on Shodoshima, a garden island in Japan's Inland Sea, about an hour by ferry-boat from the city of Takamatsu. Associate Editor Nelson visited Mr. Yashiroda there a few years ago, as did Mrs. Avery and I last year. His courtesies and helpfulness when we were in Japan were legion. He is a talented interpreter of Japanese culture, and we are proud to know him as a friend as well as author, editor, and sensitive translator.

Sincerely,

George S. Avery

Director

P.S. For details on the "sand" referred to on page 34, see the 1961-62 year-end issue of PLANTS & GARDENS.

A typical Japanese garden, featuring trees, shrubs, rocks and water, in naturalistic desig Stepping stones, bridge, lantern and a small island complete the landscape of Katsur Villa Garden, Kyoto (property of the Imperial Household).

JAPANESE GARDENS HOLD UP A 'MIRROR TO NATURE'

Momoo Kitagawa

Courtesy Asahi Evening News

NATURAL materials such as plants and rocks are used in designing gardens in both the East and West. The distinctive feature of Japanese gardens is the manner in which these materials are used, and the mode of expression of arranging these materials.

As is well known, the leading types of European gardens are the Renaissance-style garden composed of terraces, and the French-style gardens laid out in geometric designs. In contrast to these two artificial-style gardens is the English garden, in which the natural scenery is enhanced by artificial touches.

Japanese gardens and English gardens have one point in common; that is, both place emphasis on the preservation of natural beauty. However, there is great difference in the manner and mod of reproducing nature.

In the English-style garden, artificia touches are added to the natural scener to supplement what is lacking in orde to enhance the existing landscape. In th Japanese garden, various natural mater als such as trees, rocks and ground ar used to create a compact and ideal natura landscape in miniature.

To begin with, let us take a relativel large-scale garden. The main parts of th garden are the pond, which takes up th major part of the entire garden, and th mound that is raised along this pond Natural rocks of various sizes and shape are laid around the pond, a sandy beach i

created and a stone wall is erected.

A number of small islands float on the pond. Pine trees are planted on the islands and a bridge is built from the shore to the island. It may be possible to hear a waterfall, or the song of a clear stream. A narrow path runs around the pond and over the mound.

It is possible to walk around the pond by following this footpath. Tea ceremony houses and arbors of simple and artistic design are built here and there in the garden. The garden is so laid out that the entire landscape can be viewed from any place, and each view points out the specific beauty of a certain section.

Artistic stone lanterns, stone water basins and stone bridges are other additions to the Japanese garden. Evergreens, which remain the same throughout the year, are preferred rather than beautiful and colorful flowering plants.

The pine is the tree most widely used in Japanese gardens. The pine is regarded as the king among garden trees, and the Japanese gardener pays untiring attention to the pines in the garden to see that they retain their ideal appearance.

Of all the large landscape gardens, the most famous is the garden of the Katsura Detached Palace. It is located in the suburbs of Kyoto, the ancient capital of Japan. It is the garden attached to the Imperial villa, which was built in the 16th century.

This garden, which covers an area of approximately 20,000 tsubo (720,000 sq. ft.; 16.5 acres), is laid out in front of the simple and elegant wooden palace which is regarded as an ideal Japanese dwelling. Visitors to this garden stroll along the path that winds along the shore of the artificial pond which takes up the

The Golden Pavilion. This exact reproduction of the original structure which was built in 1394 was the villa of the Shogun Yoshimitsu. The adjacent garden area remains much as it was five centuries ago.

Shugakuin, Kyoto (property of the Imperial Household). This 69-acre landscape was la out in 1629 by the Tokugawa Shogun. It is one of the most famous gardens in Japa noted for its great trimmed hedges, covered bridge and magnificent "borrowed scenery" the distance.

greater part of the garden.

During this stroll, visitors will come across hillocks covered with rare Oriental plants and trees, groups of interesting rocks, the sand bar that projects into the water, the natural stone bridge that measures several meters long, moss-covered ancient pines, deep ravines, a rock garden from where the entire garden can be viewed and a stone wall modeled after a river bank.

Several simple and elegant arbors are built along the course. A stroll through this garden will give the visitor an opportunity for reflection, or a chance to listen to the song of many birds while enjoying the scenery.

Frequently, the method of reproducing famous scenic spots is taken in designing these large gardens. This is called "shukukei" (reduced scale scenery).

Compared to these extensive landscape gardens which are appreciated and enjoyed while strolling along the winding paths, there are smaller gardens that can be viewed from the living room. Even in these small gardens, there may be a por and a rock garden with trees.

The garden is like a picture scroll. N ture in miniature is reproduced befo our eyes. Here we can see the peculi attitude of the Japanese toward life, which they join nature with their ever day living.

The gardens of Zen temples are t most distinctive of this style garde There are no artificial garden trees ponds in this type garden. A number rocks, sand and moss are the only m terials used. In short, these gardens a not a reproduction or interpretation nature.

They are designed to symbolize a suggest the beauty of nature. This style garden was developed primarily for Z temples. The most famous of these sy bolic gardens is that of the Ryoanji Te ple, in Kyoto City. It was laid out in t 15th century.

The Garden of the Ryoanji Temple a rectangular plot of about 100 tsu (3,600 square feet). Fifteen rocks a

Daisen-in (Monastery Garden), Kyoto. This small walled garden includes only camellia trees and numerous "distinguished" rocks of varying shapes. The carefully raked sand that simulates the sea is actually coarse pebbles, as at the Ryoanji Garden. Daisen-in is generally regarded as the most unusual small stone garden in Japan.

arranged on the white sand. Not one tree or plant is used. This garden may appear as a mountain stream flowing swiftly through a gorge or it may appear as islands in the open sea.

To others, it may be taken as an interesting contrast in black and white. Everyone, however, will sense complexity within simplicity. They will hear voices within silence. This garden expresses the symbolism and mystery of Zen, and is similar to the Indian-ink drawings.

The Garden of Ryoanji does not conform to the general idea of a garden but it is a garden that was designed with the object of preserving permanency. It is a garden that became a truly living garden by resorting to the paradoxical. We can see the essence of Oriental art in the Garden of Ryoanji.

It can be said that there are no other gardens composed of only rocks and sand. Many gardens use moss instead of sand. Also, several trees are usually used.

Another conventional style garden is that which is attached to the tea arbor. In the Western conception, this type of small garden may not be regarded as a garden in the true sense of the word. It will probably appear as a narrow footpath among low evergreens. Actually, this is all it is; a narrow footpath leading to the small structure where the tea ceremony is practiced.

This style of garden is designed to give the impression of strolling along a quiet footpath leading through a mountain forest. The object of such a garden is not to enjoy the beautiful landscape. It is a place to be used as a refuge from busy everyday living; a place of quiet and repose. Flat natural stones are arranged as stepping stones. There is a bamboo gate and a natural rock water basin and a stone lantern. Everything is designed to give the effect of tranquility.

The foregoing has been a brief explanation of the three main types of Japanese garden. Generally, it can be said that the main point of difference between Western-style gardens and Japanese gardens is

Konji-in (Monastery Garden), Kyoto. This is regarded as best of the gardens symbolizing long life. The simulated rock-bound island, in the simulated sea, symbolizes a tortoise (emblem of long life, according to Japanese tradition). At the right, not shown, is a symbolic crane, also regarded as an emblem of long life.

Nelson

)aitokuji Temple Garden, Kyoto. A narrow strip of "water" borders the Temple. Rocks nd hedge complete the natural effect. The clipped hedge was originally kept low to make ossible the view of the distant mountain ("borrowed scenery"). Compare this modern view with 200-year-old print on page 82.

iat the symmetry, uniformity and recti-nearity of Western gardens is disre-arded in the Japanese garden.

In the use of materials, too, emphasis placed on their natural forms, and they re used in such a way as to give a more eautiful effect.

Rocks are the most important material designing a Japanese garden. The meth-d of forming the structure of the garden ith stones can be compared to the method f Japanese drawing in which the design sketch) is used to determine the outline f the painting.

Consequently, it can be said that the eauty of the form of the rocks and the eautiful effect of the arrangement of iese rocks must be fully appreciated if ie is to understand the real worth of apanese gardens.

From olden times, the Japanese have een interested in the use of rocks in gar-ens, and their appreciation of natural ocks has been developed to a high level. number of modes of arrangement and rouping have been perfected. In many ises, religious or literary names have en given to the main rocks in a garden. Stone lanterns are used for the same irpose as rocks. Besides these, the visi-r to Japanese gardens will be attracted to the bamboo gates and fences. Their simple and neat shapes blend perfectly with the surroundings.

The development of Japanese gardens is closely knitted in with the Japanese people's love of nature and artistic sense, and also to the climate of Japan. Japan is rich in trees and clear streams. The whole of Japan is one large natural garden.

The Japanese garden changes with the seasons, presenting a scene peculiar to each time of the year. The garden that is full of cherry blossoms in the misty springtime will be transformed into a garden of crimson maple leaves in the crisp autumn.

The verdant landscape presented by the garden of summer, and the snow-covered garden of winter, do not appear as the same garden. Even in one day the garden presents different aspects. In the morning and evening, on rainy days and clear days, the same garden will appear different. One must consider the season and time of day in appreciating Japanese gardens.

In conclusion, I would like to add that the Japanese garden of today, like our mode of living, has changed. Modern gardens are gradually changing into a mixture of the Western and Oriental styles.

A small private tea garden, viewed from a living room.

ROJI AND OTHER JAPANESE GARDENS

Kan Yashiroda

LET ME take you, a garden enthusiast visiting Japan for the first time, on a leisurely ramble among Japanese gardens. But before we begin, there come to mind words written about American gardens some years ago by Mrs. Francis King, one of the founders of the Garden Club of America. She said, "I venture to say that taste in the good present-day garden here has never been surpassed in gardens anywhere. We have had all t world to draw upon for suggestion; v have by no means imitated. Our varie of climate, soil and plant subjects limitless. As an imaginative people would be strange if in the past years wi the *furor hortensis* raging on all sides v had not accomplished something good gardens."

Unlike your gardens, in ours neith

ambitious human effort nor nature in its spectacular phases is prominent. Within but limited space and with the help of a few selected stones and plants one is led on a meditative journey. The type of Japanese garden we are chiefly concerned with here is confined. It is unlimited in only two dimensions: one, the open space above; the other, the imagination of the spectator.

Roji, the Dewy Path

The most refined or condensed of Japanese gardens are the *Roji,* gardens leading to and connecting with the tea house. In walking through such a Roji (literally, dewy path) you may recall the narrow borders gay with annuals along the paths in your own garden and you soon realize that this garden is founded on a different idea—one of quiet tastefulness, known in Japanese as *Wabi.*

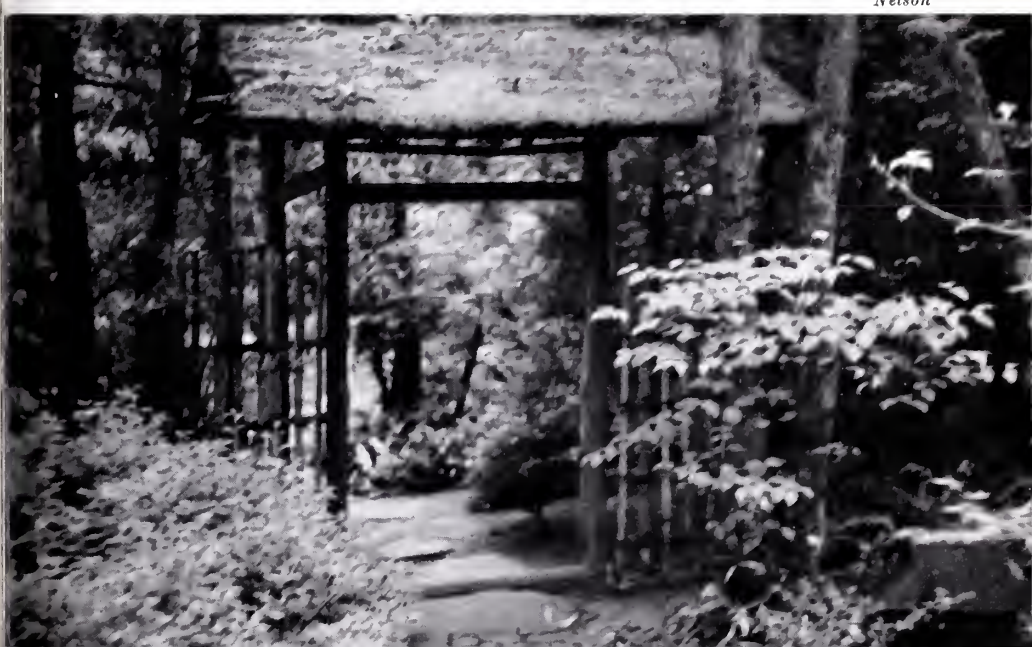
As Japan entered into feudal times at the end of the twelfth century, the elegant taste in gardens which had characterized the dynastic period changed to one based on ideals of the Zen sect, as this sect infiltrated among the people and its tea ceremony grew in popularity. As the tea ceremony was refined, gradually the form and technique of Japanese gardens were changed to be suited to the ceremony. One of the great masters of the tea ceremony was Rikyu (1520-1591), a genius not only with respect to the tea cult but in all arts and life itself. During his time the form of Roji, the dewy-path, was definitely established. The aim and idea of Roji is quiet taste, a feeling of nature one would have upon walking in a remote mountainous region though actually he is strolling only a few paces along a narrow border of selected woody and herbaceous plants and stones.

Here we might recall that at present there are more than 93,400,000 people living in Japan, but there were many fewer in the times when Roji were originated and developed. The desire to enjoy oneself in quiet meditation—to find oneself—is independent of population.

At the age of 19, Rikyu had learned the tea cult in a style of refined simplicity from Jowo (1503-1555) and later practiced Zen meditation under the priest Kokei (1514-1597). Perceiving the profundity of the sect he became convinced that the practice of the tea cult must

A garden gate

Nelson



Drawn by Mei Yashir

Stone water basin (see text below)

be united with the ideals of Zen. So he originated and advocated performing the tea ceremony in secluded tea houses in order to cultivate and appreciate Wabi, quiet good taste. Naturally the passage leading to the tea house, and the plantings, arrangement, and landscaping on both sides of the path were considered. Hence Roji, or a garden adjoining the tea house and carrying out the same ideals and taste, was originated by Rikyu's genius.

As the age advanced, elaborately designed and complicated Roji gardens developed and came into fashion, and even in large gardens one or more Roji were included.

A tour of Japanese gardens directed by a regular guide book would be quite satisfactory and pleasant, but so far as Roji gardens are concerned, the best ones would be missed. This is because, although I venture to say that Roji are the cream of Japanese gardens, they are neither large enough to be included in guide books, nor are they generally publicized. They are scattered throughout Japan a most of them are private gardens. Go luck or accident could lead one to ma fine Roji gardens in a few days alm anywhere in Japan, if one wishes to fi them.

Wash Basins

In a Roji garden, one of the first thin to be noticed is a stone wash basin with few stones placed in front of it. Th stone arrangement is called *Tsukub*. The one shown here is typical. The sto placed on the right front side of the wa basin is called *Yuoke-ishi,* the stone place a pail on. The left front stone *Teshoku-ishi,* the stone to rest a eand stiek on. The front one is *Mae-ishi,* simply the front stone.

Before guests enter the tea house, ea steps, one at a time, on the front sto and in a half sitting posture washes h hands and rinses his mouth, ladling t fresh water the host has just provid from the wash basin or *Chozu-bachi.* a garden lover it may be of interest

know that the ladle used at a Tsukubai is made of Japanese-cedar wood (*Cryptomeria*), while one provided for the wash basin placed close to the extended porch of a drawing room or an abbot's chamber is made of Hinoki cypress wood (*Chamaecyparis obtusa*). Obviously, the tea ceremony in the latter will be heavier in mood and formality, and the wood matches in its character, quality, and appearance the particular ceremony it is used for. This latter construction is called *Hachimae*. It consists of a wash basin close to a small extended porch added on to the regular porch of a room, with several stones, each with meaning and purpose, around it. To light it, a stone lantern is placed near it or a metal lantern hangs down from the eaves. The whole is backed and partly surrounded by an elegant low fence or shrubby planting. While in Japan one will often come across *Hachimae* in varied ideas and designs.

To return to the Tsukugai of the Roji garden: whenever a tea ceremony is held in winter, a pail filled with hot water is provided on the Yuokeishi; while a lighted candlestick is provided on the Teshokuishi when early morning or evening tea ceremonies are held.

Cobble-stones

To conceal it from view, to keep it from being choked by fallen leaves, and to avoid splashing, some cobble-stones are placed on the sink as shown in the sketch. But this is not the only purpose of the cobble-stones—they also provide an accent. So, sometimes, old figured tiles are added. How men of other days felt difficulty in arranging the cobble-stones is well told in an old book. The author says, "It is difficult to place the cobble-stones on the sink. Some of our predecessors shut their eyes and then picked up several cobble-stones regardless of size and shape in a receptacle. Still keeping their eyes closed they then spread these on the sink. If one places them by hand while thinking on the arrangement, they will be too well arranged and naturalness will be lost; there will be no arrangement worthy of appreciation."

Another type of water basin, with ladle

Stone lanterns in the Castle Garden, Takamatsu, Island of Shikoku

Stone Lanterns

I am sure that readers will have already seen or read about either old weather-beaten or newer stone lanterns in gardens. The lantern has its origin as a solemn votive offering to a Deity or Buddha at a shrine or temple. The garden lanterns adapted from such dignified offerings and refined for many centuries as garden ornaments and for practical use have, naturally, come to have varied forms and sizes. Many ancient stone lanterns can be seen at temples as well as in gardens. The old wooden and metal lanterns placed often in Roji and other gardens, as well as in other places, are also worthy of study and appreciation.

As one turns from the dedicatory lanterns to those of the garden, the underlying tone is found to become aesthetic and humanistic; consequently, some forms were fancied and originated by the masters of the refined life, and they came to stay as the formal popular styles. Such forms as an old granite lantern dedicated to a shrine in the Kamakura period (s illustration) and the related grand ston lanterns are preferred in some recent gar dens. The two stone lanterns to be see in the castle garden formerly belongin to the Lord of Takamatsu reflect the mag nanimous character of the feudal daimyo These were erected in the Tokugaw period (1600 to 1868). Incidentally, th stepping stones in the castle garden a Takamatsu are enormous, each attain ing some 5 feet in diameter in keepin with the huge stone lanterns.

In the outskirts of Kyoto at a plac called Takano is found Rengenji templ where a couple of elegant stone lanterr a little over 6 feet high, and said to hav

Stone lanterns of many types. **C** is the Orib type (about 5 feet high) and appears in th Japanese Embassy garden in Washingto D. C. **E** is also in the Embassy garden. Th original (about 1 foot high) is in th Katsura Villa, Kyoto; the openings in th carved stone represent moon, sun and star **G**, the rarely seen Kanshuji type (abou 4 feet high).

A
B
C
D
E
F
G
H
I

been erected in *Kanbun* (1661-1672), are to be seen. The picture on page 14 shows the form, which is popularly known as the Rengenji form of stone lantern. For centuries it has been a favorite in Japanese gardens. It is worth going as far as Rengenji to see the original pair, and also it would be to your delight to find a weathered Rengenji style stone lantern in the quiet and secluded atmosphere of a Roji garden.

Of those stone lanterns erected nearby to light the Tsukubai, one sees most frequently the *Oribe* form. It is said to have been originated by Oribe (1542-1615), a great master of the tea ceremony and a feudal lord. The square stone lantern has no pedestal and is fixed in the ground. It is said that an image carved in the support represents the Christ or the Holy Mother and that the bulge on its upper end symbolizes the cross, so the Oribe lantern commemorates the martyrs among the early Japanese Christians. Unlike the hexagonal shape most common in stone lanterns, the square is something freed from traditional ideas about lanterns, and is well fitted to the garden and house.

The *Urizane-doro* (literally, melon seed) stone lantern has an oval shape which is most peculiar (**D** in sketch). It is only 21 inches high, but for several centuries it has been much talked of. It was made of a discarded stone memorial. It is still to be seen at the Shinnyoin temple, Kyoto. Another peculiar and fancy small stone lantern is one called *Sanko-doro,* or three-light-sources-stone, in the the Katsura Palace Garden, Kyoto. It is said to represent the sun, moon, and stars (**E** in sketch). This stone lantern is highly thought of. Another famous stone lantern at the same garden is *Hotaru-doro,* the firefly lantern, which is pictured on page 65.

Yukimi-doro is a popular and widely seen style, an example of which is in the Brooklyn Botanic Garden. The one shown at **F** in sketch is there and is rather unique in having a hexagonal shape but with four legs. The common Yukimi-doro has an exceptionally large octagonal or round-ish hood with an easy pitch. The leg number three or four.

When you visit the noted garden o Kanshuji temple, Kyoto, the origina *Kanshuji* form lantern will be seen in corner of a little garden enclosed by hedge. As shown by the sketch, it ma be called a modified form of Yukimi Every part of this lantern is square. Th hood is 45 inches long and 35 inches wide The height is a little over 50 inches. Th form is so nice that we can easily imagin the days when it shed a warm, tranqui rushlight over the garden through it four large sliding paper sashes.

A form of small lantern can be seen a Rengenji, where the Rengenji style origi nated. The *Manshuin* form is the sam as the Oribe form, square and fixed in th ground. It also is welcomed in the garden A well proportioned *Nishinoya* form ha refined simplicity. It will be found among some thousand lanterns at the Kasug shrine, Nara. Also at this shrine are many other forms, including a grand hooded *Sekishu* form, the rest of which is mad of one stone; and the finely carved *Han nyaji* style. On the island of Shodoshim in the Seto Inland Sea National Park where I live now, besides the larger ordi nary sized ones, lanterns some 10 inche high are made in Yukimi and other styles They are popular with foreigners.

Plant Materials

The area of a Roji garden is covered with varied material according to th climate, physical condition of the garden and the owner's taste. To the plant lover a Roji garden whose landscaping is based upon and formed by plantings is a mos pleasing and appealing one. The plant ings are so varied in motif and practice that no two are alike. The general prac tice is that some evergreen or deciduous tree, or both, with underplantings of low shrubs and herbaceous plants are ar ranged with or without some stones. Some columnar-trimmed cryptomeria trees planted together in a spot or two make the visitor feel the atmosphere of moun tainous regions; while a Roji garden with a planting of deciduous oaks, with herba

Nelson

Under dwarf bamboo it is a common practice to place boulders, as pictured above. The cobble stones represent the bed of a dry stream.

ceous plants underneath on both sides of the path, seems to be part of a natural woodland. Dwarf bamboos are often well used for the underplanting, as shown in the illustration above.

Elegant Simplicity

Kotan, elegant simplicity, is the governing idea of a Roji garden. For centuries there have been created, as the highest reach of such landscaping, gardens planted with only a tree, or with a tree and a stone only. In others Kotan was achieved by planting only one kind of plant, such as Japanese flowering cherry or bamboo.

The Roji garden covered with moss is not easy to make and maintain everywhere, but where it is possible to keep, it is fine and interesting. The best moss garden is to be found at Seihoji, Kyoto, which is popularly called the Moss Temple.

Unlike the moss garden, a sand-paved Roji is easier to keep, although it is not to be neglected. Its soul is neatness and cleanliness. Not only the sand, but everything in the Roji garden which is constructed near and connected to the tea house must be neat and clean, as must the visitor himself, to come up to the example of the tea house itself.

Symbolic Gardens

The history of *Karesansui,* gardens in which water is completely excluded and instead of using actual water, waterfalls, streams, the sea, and other watery scenes are symbolized with stone and sand, goes back to remote ages and came to its height of development and popularity in the Muromachi period in the 15th and 16th centuries. The technique of expressing water in a realistic or surrealistic way on sand has called for resourcefulness. Some of the popular ways are to mark ripples, the "floating chrysanthemum crest," and the flow of the water with a specially made broom.

In the larger Japanese gardens, often a large part is paved with sand. Good examples are to be seen at the gardens of

Yashirod

This corner of an abstract garden of "dry water scenery" (*Karesansui*) represents a rang of mountains, in miniature, with a stone bridge and simulated stream. Daisen-in, Kyoto

Grassy garden with low sheared azaleas. A meandering stream, stepping stones and a occasional low stone bridge complete the landscape. This garden once belonged to Marqui Yamagata, an important figure in political life in Japan during the Meiji period. Murina Garden, Kyoto.

Daisen-in, Daitokuji, Ryoanji, and Nanzenji temples, Kyoto (see pages 7 to 9). As shown in the pictures, the sands often symbolize the sea. Likewise the rocks and trimmed shrubs represent islands in the vast ocean. How the spaces of land and air make a garden feel larger than it is and suggest a grand view is seen in the garden of Nanzenji temple, from which the sketch was drawn. At old bookstores in Kyoto or elsewhere, ask for *Miyako Rinsen Meishozue,* six volumes, 7 by 10 inches, in an old Japanese binding, in which over a hundred noted gardens in Kyoto are shown in wood-cut prints. It was published in 1799, and in it the Nanzenji temple garden is depicted. The garden was designed and constructed by Kobori Enscho, a feudal Lord and a most famous landscape designer, in 1611 or a little later. In it the hill in the background is included in the view. Such a technique is often seen in Japanese gardens—it is called *Shakkei* or borrowed landscape.

The use of grass became popular in the last three or four hundred years for Roji and other gardens. A very fine grass, *Zoysia matrella* var. *tenuifolia,* is used. Murin-an is a typical grassy garden, with low trimmed azaleas.

Roji in Winter

If one visits a Roji garden in winter he will sometimes see pine needles laid over the garden. This laying of pine needles is called in Japanese *Shiki-Matsuba.* In olden times when Rikyu developed and refined the tea ceremony and the Roji, he scattered leaves of deciduous plants, such as deciduous oak, together with pine needles to look like the leaves shed by the wind in the woods. But nowadays almost always pine needles alone are used, for the purpose of protecting the moss and other plants from severe frost damage, and to make the garden more neat and tidy in appearance. Moreover, the broad deciduous leaves decay more quickly and spoil the moss. If you are a garden stickler, you might be interested in learning from a veteran landscape gardener how detailed and varied is the technique of laying the pine needles, especially along the edge. If you should be lucky enough to buttonhole a man with such classical talent and skill in gardening, he could plainly convey to you the details by the "universal language!"

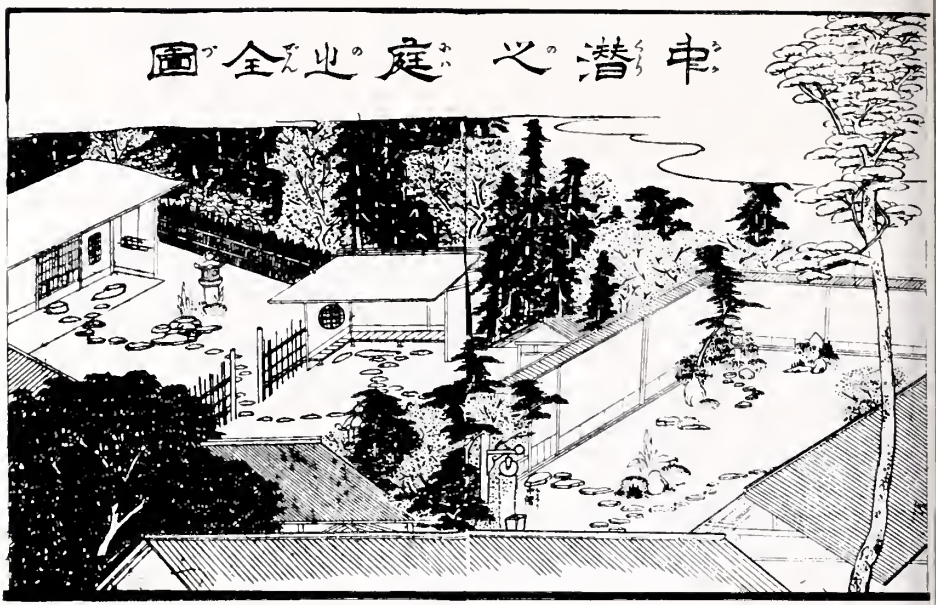
Stepping Stones

In a Roji garden stepping stones lead the visitor from the gate to the entrance of the tea house or room of the main house, but these are not laid only for the practical reason of being walked on. As a basic rule Rikyu said that stepping stones should be laid to give 60 per cent consideration to practicality and 40 per cent to appearance, while Oribe, another great landscape designer, taught for practical use 40 per cent and for looks, 60 per cent. In any event, since Roji means a dewy path, a winding path across field and wood, with dewy grasses along the sides, is kept in mind in the laying of stepping stones. There are many formal ways of laying the stepping stones, as shown on page 22. Variations are practiced according to the surrounding landscaping, or the aesthetic ideas of the gardener. One of these variations which has become formalized and popular is the Plover-repeat or Tottering-step-repeat. Others are the Wild-geese-flight-repeat and the Fallen-leaves repeat.

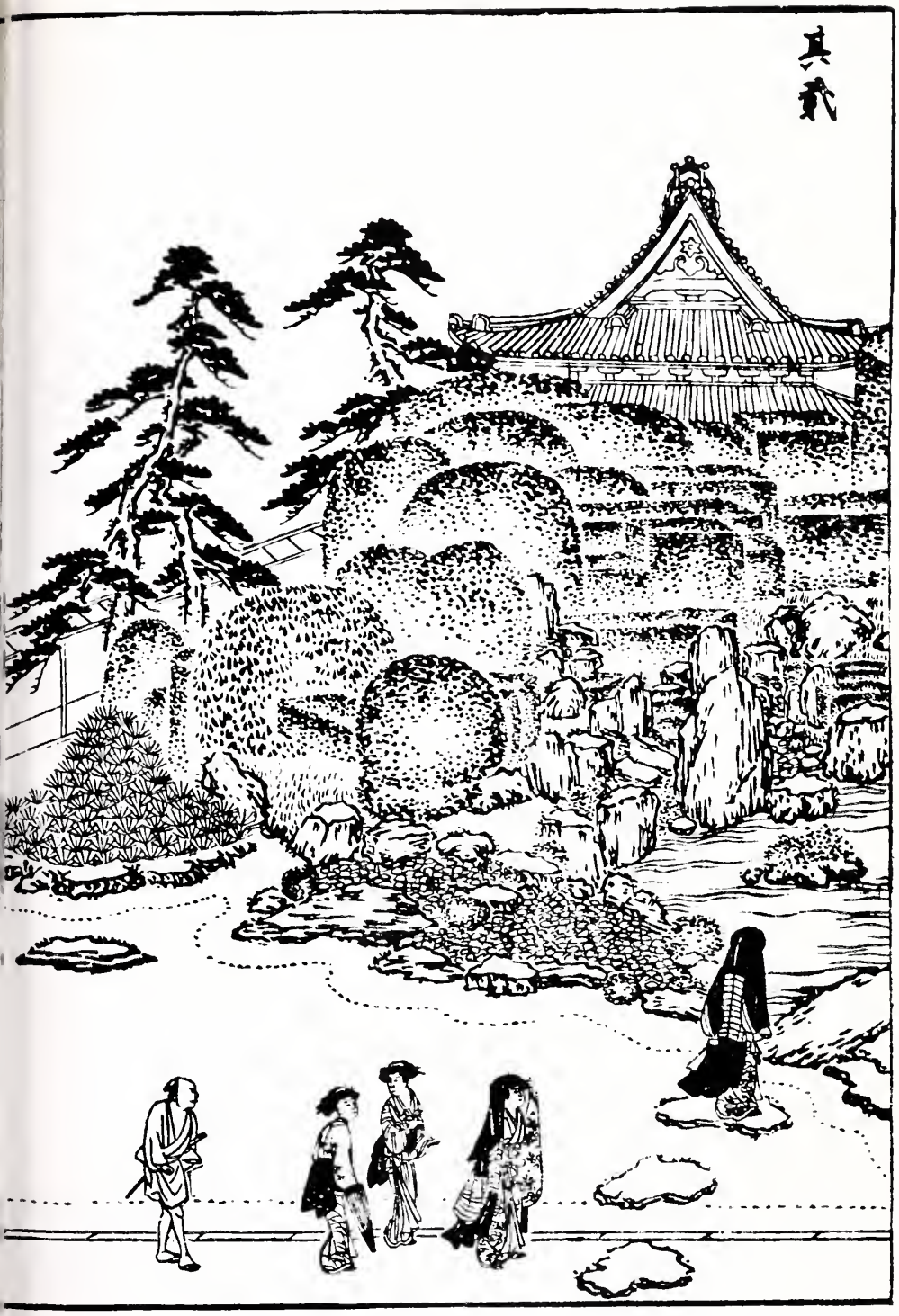
Other Stones

In gardens connected with a room of a house or with a tea house, between the stepping stones and the entrance is found a large flat-surfaced stone called *Kutsunugi-ishi,* or the stone-where-shoes-are-taken-off. In gardens connected with secluded tea houses it is called *Fumi-ishi* or step-on stone, though it serves exactly the same purpose (to take off the footgear). Sometimes, when the entrance is too high, another stone lower than the Fumi-ishi but higher than the stepping stones is laid between them to ease going in and out. This is called *Ochi-ishi,* meaning that it is lower than the Fumi-ishi. Still another stone called *Nori-ishi,* or transferring stone, is often added.

We have already discussed many stones



Illustrations of Japanese gardens from *Miyako Rinsen Meishozue*, Book of Famous Landscapes, by Tazaemon Ogawa, Kyoto, 1799 (Kansei Period). The illustration on page 82 is from the same book.

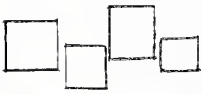

其弐

ONE-
REPEAT

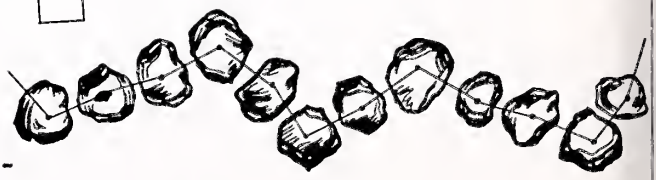
TWO-
REPEAT

THREE-
REPEAT

FALLEN-LEAVES-
REPEAT



PLOVER-REPEAT
OR
TOTTERING-STEP-REPEAT



WILD-GOOSE-FLIGHT-
REPEAT

Yashiroda

A typical garden well at Saihoji, Kyoto

with definite meaning and position in the garden. Whether they retain their practical use or not they are an indispensable element. There are many more "position" stones in Japanese gardens whose history it is interesting to trace, and which can be seen and enjoyed in the gardens themselves.

Wells

The well has held an important position from the beginning of Japanese gardens and is associated with the thought of purification of Shintoism and with the practice of offering purified water for departed spirits in Buddhism. Moreover, in the Roji garden which is connected with the tea house it is essential to have very fine water for the tea. It is said that many old masters of Chanoyu (ceremonial tea) built their tea houses and gardens where the water was very good. Besides a supply for the tea, water is essential for sprinkling and watering in the garden and for supplying the wash basin for personal purification. The one shown here is a typical and historical well in the garden of the Moss Temple, Kyoto. The well is generally enclosed with a square or rounded well-crib, with a drawing stone placed close to one side. On the other side a wooden pole with a neat roofing is erected to support a wheel and well-rope and buckets. The well is covered with bamboo screens. Traditionally, a tree is planted close by, for enjoyment of the guests.

Pavements

The history of pavements in Japanese gardens is a long one. At the beginning it seemed to be customary to use natural stones as well as hewn stones, and broken pieces of tile left over from building the house and garden. Hence some formal styles of paving with such mixed materials

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Patterns used in laying stepping stones

Yashirod

Path paved with cobble stones

now look unnatural. However, some nice ones producing a unique expression and harmonizing with the surrounding atmosphere would not be hard to find.

There are many formal patterns and materials for paving paths and for other uses. The cobble-stone-paved path as shown on this page matches well with the natural setting under the shade of the taller trees. In the rainy season it frees the rambler along the path from the mire, for which Japanese roads and streets are notorious. The cobble-stone path transfers in a natural way to the stepping stones in the garden.

Karesansui, the Dry Garden

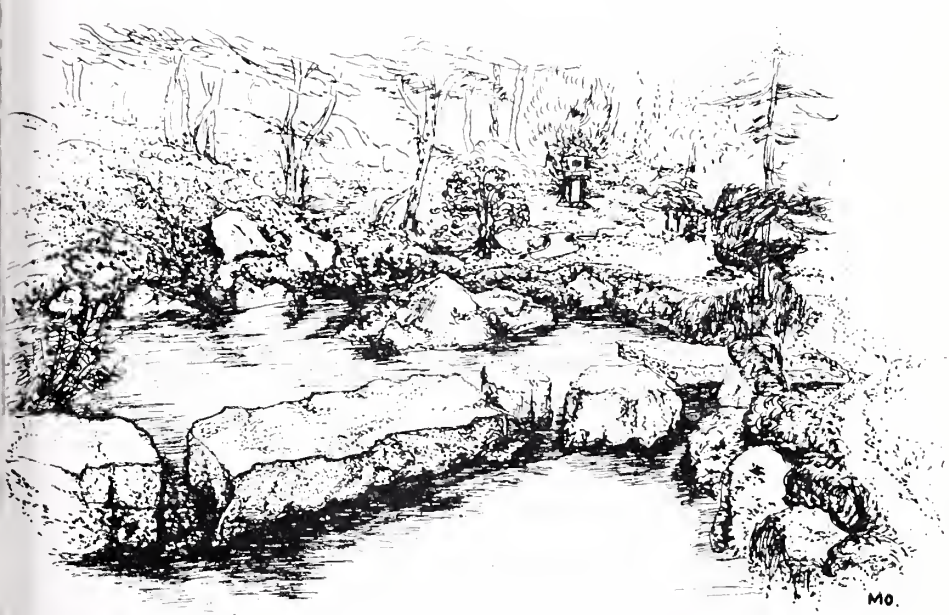
As touched upon before, Karesansui, the garden without real water but with water symbolized, consists, except for a few plants, of rock, stones, and sand. It shows vividly that we Japanese read many things into these inanimate materials and feel spiritual affection toward them. The technique in these gardens is to represent abstractly ideas such as the island of eternal youth introduced from China in ancient times, or Mt. Shumisen of Buddhist mythology. Also fine natural landscapes, noted mountains, cascades, streams and such are reproduced in miniature. The illustration on page 18 shows a well-known dry garden seen from a porch. Note the few small shrubs and ferns. The white sand stream flows under the stone bridge. Water is also expressed with gravel and small cobble-stones with which it is more difficult to show the variation of the current in either a realistic or an abstract way.

Other Gardens

Unlike the Karesansui gardens which were developed during and were the dominating feature in the Muromachi period, and in which stones are used as the subject of abstraction, the gardens planned and constructed in the following Momoyama period, in the late 16th and early 17th centuries, use stone in a pompous manner. Also in the gardens of this period rocks and stones are used as the

Drawn by Motoki Yashiroda

Raked sand simulates the sea in the garden of Nanzenji Temple, Kyoto.



Drawn by Motoki Yashiroda

Stones are magnificently used in this garden of the Jisso-in Temple, Kyoto.

Picturesque pines are an important feature of the rugged, beautiful Japanese coastline

ıcans of reproducing the features of ıtnre itself and in such use the pompous ·ends of the Momoyama period are ɛflected. So there is in these gardens no ɔuch of the fragility which is believed ɔ be inseparable from things Japanese. he sketch of the Jisso-in temple garden ill make clear to readers how huge stones re used, as stepping stones, for example, ɔ express nature's magnificence and at ıe same time symbolize a bridge. To ıatch these, a few large stones are placed s a peninsular island at the far end of the dge of the pond. If you visit there, you ·ill find an amusing trick of the designer. ietween the island and the stepping tone, deep under the surface of the water, large, long stone has been sunk. This is nother superfluous and pompous note, as ften seen in nature.

Trees Used

Anyone coming to Japan for the first ime, whether by air or by sea, will he truck, on his first clear glimpse of our ountry, by the fact that pine trees domiate the scenery. Later on, he will find hat it is the same, also, in Japanese garens. Pine trees are concerned with and ave influenced every sphere of our life ince prehistoric times. Whenever a Japaese is in a "No-pine-land" where the ıxurious growth of various other trees is een, he feels, almost without exception, ostalgia for pines. The permanent greeness and durability to natural rigors inluding the annual typhoons, together with ther virtues, has developed in the Japaese affectionate love for pine trees.

However, Japan is not lacking in a ariety of indigenous trees. Indeed, in apan woody plants in the temperate egion are developed and varied to a high legree. Therefore, not only pines, but ther conifers which have the same virtues f evergreenness and absence of seasonal hanges have been planted in gardens. Some of those which have been appreciated in gardens for centuries are listed n page 28.

To one or more kinds of evergreen enerally some deciduous trees and shrubs are added to give a lighter air and to add the charm and elegance of their seasonal changes. The following list gives some of those which have been preferred and planted since olden times. There are, as well, occasional plantings of many other Japanese flowering trees and shrubs, some of which are frequently seen in European and American gardens. One may wonder why the world-renowned Japanese camellias which were developed and came to almost insane fashion for several centuries past are not a dominant feature of our gardens. They are too gorgeous in color and form except for some small-flowered single ones such as 'Wabisuke' and 'Tarokanja', which are thought to be better and much to be preferred as the flower for arrangements for the tea house. Another reason is that the samurai class came to detest planting camellias because when they come to shed their flowers they drop them completely, as one beheaded. However, even in Roji gardens cultivars of camellia are sometimes liberally planted, as in the past certain noted Roji gardens were planted exclusively with Japanese flowering cherry or *Cycas revoluta*. Such gardens were, evidently, not only to satisfy their owner's taste for particular plants, but were to show his skill with plants that were considered peculiar or generally thought to be unsuitable. Although the kinds of plants for gardens have been very restricted, rare and unusual flowers of both woody and herbaceous plants have been much sought for flower arrangements. In the case of the gardens, it is intended that refined quiet simplicity should rule and any showiness should be added in such a way as not to break this atmosphere. In the case of flower arrangements, a few showy or noticeable flowers are selected, sufficient to brighten the whole room but not to break the refined quietness in it. These examples show that one will not see many garden varieties in Japanese gardens—our gardens are not show places for plants as are gardens in the West. Still, owing to the demands of Japanese flower arrangement and also to the efforts of plant fanciers over the centuries, we have de-

veloped numerous varieties of garden plants.

In the gardens are many meaningful plantings, backed not only by mysticism and symbolism, but by the artistic point of view. One of these is the *Hisawari-gi* or light-interfering tree that is planted close to a stone lantern to hide part of it from sight. Others are the *Iozoeno-ki,* the tree attached to the tea house to partly conceal its tablet from view; the *Kakitomeno-ki* planted along the edge pole of the fence; *Hachihikae,* the wash basin tree which shades the basin and is mirrored in the water; and the *Monkburi,* the overhanging-the-gate tree.

I have rambled with you mostly through the smaller gardens such as the Roji, t me the cream of Japanese gardens. Thes are not gathering places for every ite thought to be essential and often seen i Japanese gardens in foreign lands. The are often constructed with as few of th so-called essentials as possible, but th best ones were designed and constructe by men who respected the traditions an who considered every traditional garde item. In these gardens there lives feeling of refined tranquility and spiritu unity with men. As an imaginative reade I am sure you have grasped something o this from my account of these sma Japanese gardens.

Plants Commonly Used in "Roji" Gardens

Conifers

Cryptomeria japonica
Juniperus chinensis
Chamaecyparis obtusa (Hinoki cypress)
Podocarpus macrophyllus
Podocarpus macrophyllus var. "Maki"
Thujopsis dolabrata (Hiba arbor-vitae)
Cycas revoluta

Broad-leaved Evergreens

Quercus spp. (evergreen oaks)
Ilex spp. (hollies)
Ternstroemia gymnanthera
Castanapsis cuspidata
Photinia glabra
Cleyera japonica
Osmanthus ilicifolius (holly-leaved osmanthus)
Aucuba japonica and its cultivars (Japa nese aucubas)
Pieris japonica (Japanese pieris)
Euonymus sieboldianus
Daphniphyllum macropodum

Deciduous Plants

Acer palmatum and vars. (Japanese map varieties)
Prunus armeniaca and vars. (Japanese flow ering apricots)
Magnolia obovata
Deutzia scrabra
Stewartia pseudo-camellia (Japanese stew artia)
Corylopsis spp. (winter-hazel)
Enkianthus perulatus (white enkianthus)
Vaccinium oldhami

Plants Suitable for Difficult, Shady Situations

Shrubs and Trees

Ilex crenata (Japanese holly)
Ilex crenata var. *helleri*
Taxus spp. (yew, upright and spreading)
Pinus thunbergi (Japanese black pine)
Pieris japonica
Rhododendron spp. and vars.
Skimmia japonica
Skimmia reevesiana

Herbaceous Plants

Hosta spp. and vars. (plantain-lilies)
Ferns
Hemerocallis spp. and vars. (day-lilies)
Viola spp. (violets)
Epimedium spp.

Ground Covers

Hedera helix (English ivy)
Hedera helix baltica (Baltic ivy)
Vinca minor (myrtle)
Pachysandra terminalis (Japanese spurge)

Vines

Parthenocissus tricuspidata (Boston ivy)
Hedera helix (English ivy)
Hedera helix baltica (Baltic ivy)
Wisteria spp.

Nelson

JAPANESE GARDENS FOR AMERICAN GARDENERS

Peter K. Nelson

The preceding article by Kan Yashiroda treats at some length the details of Japanese gardens, especially those associated with the tea ceremony. Some readers may wonder what practical value such information might have for Western gardeners, aside from the intrinsic interest the subject holds. Even with the current keen interest in the West and especially in the United States, for all aspects of Japanese art and culture, it is not likely that great numbers of gardeners are going to rush out to construct Japanese gardens. Nor is it the purpose of this handbook to stimulate a rash of such construction.

Nevertheless, there is a great deal to be learned by a study of these Japanese gardens, both in design and in the utilization of space and materials, that can practically and profitably be applied to many Western gardens.

To use and enjoy these Japanese gar-

A Japanese lantern hung with a Western-style mounting

dening principles it is not necessary to become a disciple of Zen Buddhism. For most Westerners this is likely to be neither possible nor desirable. Some understanding of Zen philosophy will without doubt heighten one's understanding and appreciation of Japenese gardens—but this is an extra dividend, not a prerequisite to enjoying and using the principles of their construction.

Where to Use

Of all gardening situations for which the principles of Roji and other Japanese gardens may offer satisfying solutions, certain urban locations come first to mind. Space is at a premium in most city gardens, and frequently such areas as are available are so surrounded by walls of buildings as to be pretty well shut off from both light and air. And the soil is apt to be extremely poor, shallow and poorly drained, and often filled with debris. Under these conditions, attempts to garden in the accepted Western sense are foreordained to failure; most annuals and many perennials do not grow at all or are spindly and anemic, producing few or no flowers. Even grass, which may start out bravely when first planted, becomes thin and soft and soon dies out.

Faced with such a situation, a garden planner would be wise to abandon attempts to grow colorful masses of flowers, and try to produce, instead, a garden based on an attractive and interesting arrangement of stone, pebbles, or sand, set off by a few of those plants which can thrive under such difficulties—in short, a garden similar to the Roji or Zen gardens of Japan. If desired, a few accessories may be added, Japanese or not, according to one's taste.

Advantages

As the Japanese have so clearly demonstrated, such gardens can convey a feeling of spaciousness within a limited area by skillful use of the right materials.

A second advantage of these gardens is that they can be kept neat in appearance and in good condition without much care. This is not to say that they need *no* care, for even a bare expanse of pebbles will become littered and disarrayed if neglect-

Corner of small sand garden in Japan shows what can be achieved with sand, rocks and a few plants.

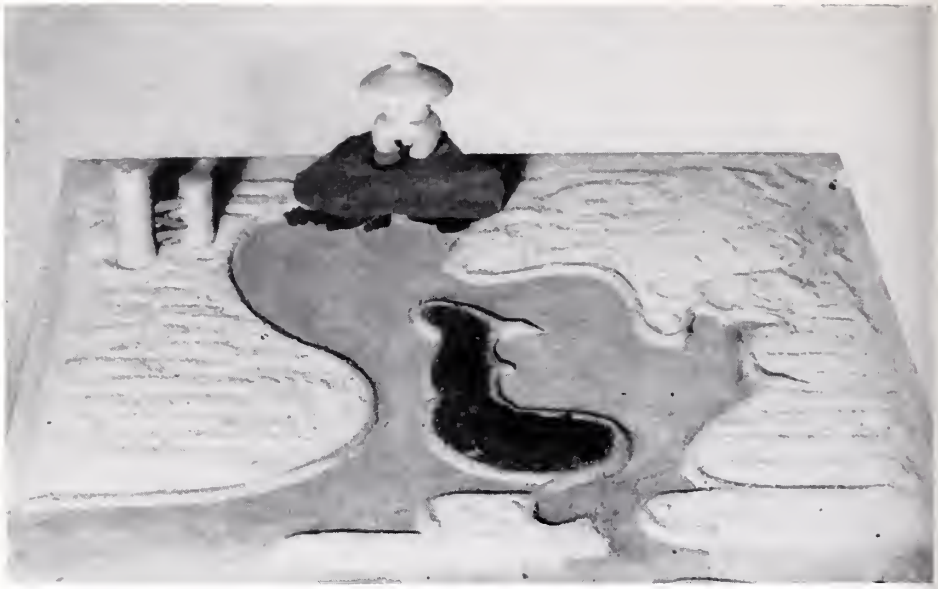
ed altogether. The point is that a garden based on Japanese principles can, with reasonable care, be easily maintained and will give great satisfaction, whereas, in the kind of situation we are considering, a typical Western "flower garden" will almost certainly be a sad disappointment no matter how much care and expense is lavished upon it.

Other Situations

Many other situations exist in which the Japanese approach may lend itself as the ideal answer to an otherwise almost insoluble garden problem. Such are, for example, narrow passages between buildings, where the light is poor, and where construction may have left the soil so full of debris that it is totally impossible to grow turf, or even the usual small trees or shrubs; or, under the shade of certain kinds of trees where root competition practically excludes all other plant growth. It should be mentioned, too, that many gardeners with perfectly satisfactory situations may wish to construct a garden based on Roji or other Japanese gardens —simply for the pleasure and satisfaction such gardens can give.

The illustrations on these pages show examples of what has been done in a few small Japanese gardens, and on pages 32 and 33 are shown models of suggested contemporary gardens of Japanese influenced design. The latter illustrate a different-from-usual treatment which may have greater appeal to some than the more traditional approach. They also show the wide variety of effects which can be achieved.

A partial list of plants which can be grown under difficult conditions is found on page 28. Some of them will bloom, so color need not be entirely lacking from such a garden. For construction details for paths, terraces, walls, etc., readers are referred to other PLANTS & GARDENS Handbooks.

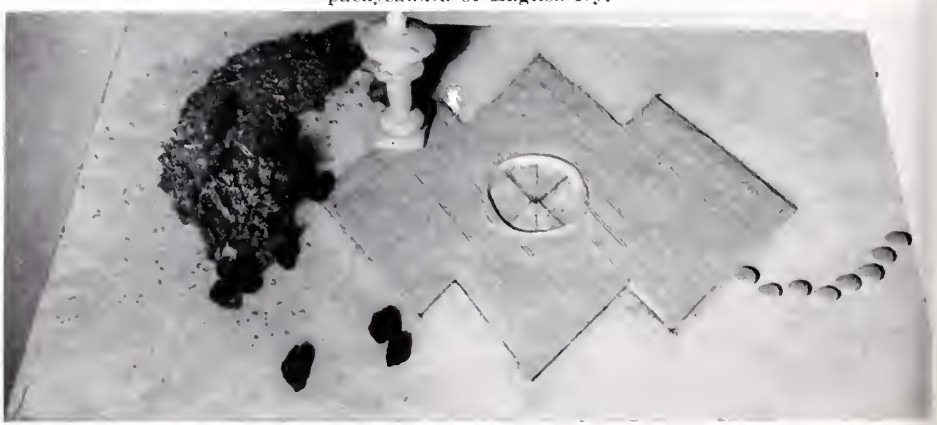


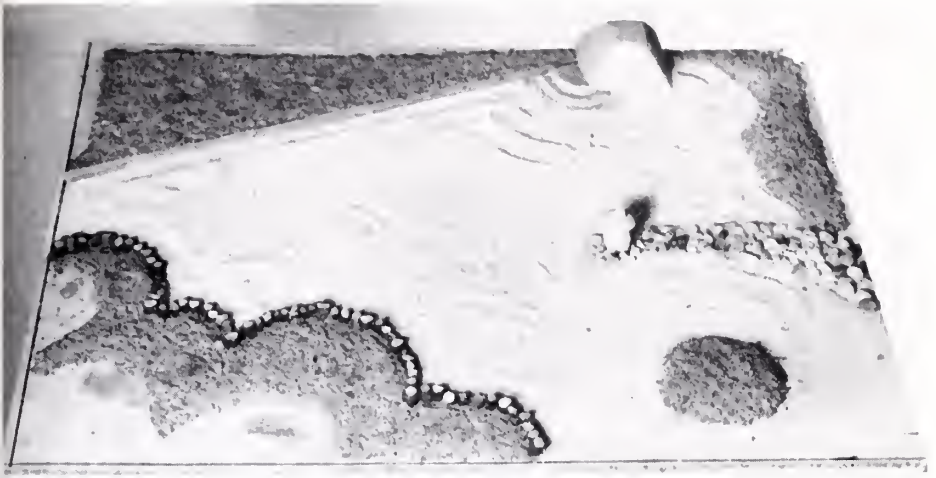
Suggested design for entrance court or backyard garden. Harmonizes with modern architecture and is easily maintained. The "island" is moss-covered and the lantern stands on a large boulder. The sand pattern is raked in Korin style. The path area around the "island" may be of brick or cement.

JAPANESE FEELING IN CONTEMPORARY GARDENS

Takuma P. Tono

This patio-style garden is more architectural than horticultural and is recommended for small areas in cities, where buildings cast heavy shade. The power of this garden lies in its double-diamond-shaped terrace and small center pool. Planting may be substituted for pool. Background planting may be introduced, as desired, in the space to the left of the hillock beside the lantern. The hillock may be planted with a ground cover such as pachysandra or English ivy.



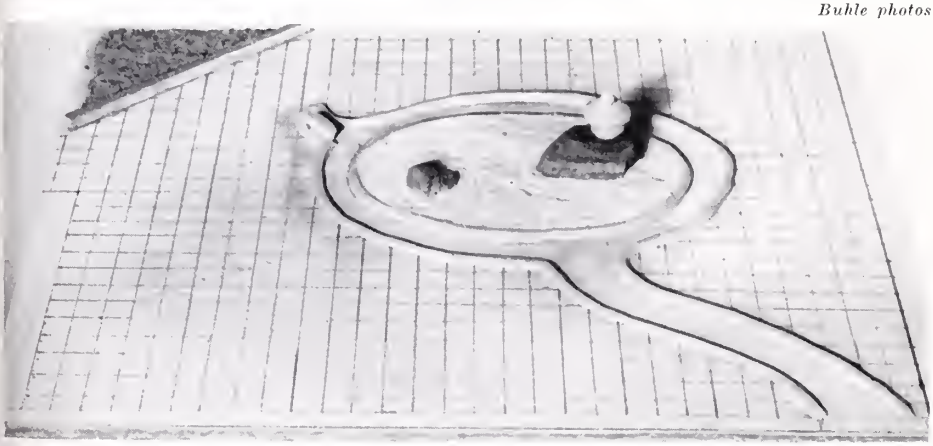


This simple garden of medium size features a triangular "sea" bordered by green lawn area (or moss) on the far side. In the foreground, the gracefully curved line of small posts suggests water-side. The low stone lantern at the end of the small peninsula gives added interest and the pyramid feature suggests the moon-viewing platform to be found at the Silver Pavilion, Kyoto. The diminutive round island is grass (or moss) covered.

While the traditional Japanese garden portrays nature, often in miniature, the more important characteristics of a Japanese Garden can be expressed in abstract designs, virtually without plants. In the accompanying photographs of models of gardens this feeling is conveyed by the use of one or more of the following: stepping stones, posts at the waterside, lanterns, key boulders, and raked patterns in sand. Water, whether real or simulated in sand gives a feeling of serenity, "the embodiment of Paradise." This quality is valuable in small city gardens especially if surrounded by buildings.

A patio-type garden with large paved area in which a circular sand area is placed a little off center. Small bench at left of sand area is for rest and meditation. Low lantern is placed on large boulder, and the smaller boulder completes the rhythmic arrangement. Triangular far corner may be devoted to a small shrub planting, grass, or small spreading tree.

Buhle photos



View of Ryoanji Stone Garden seen from platform in a wing of the Temple

THE STONE GARDEN OF RYOANJI

Takuma P. Tono

TO THE Japanese mind a garden is not only a place for the cultivation of trees and flowering plants, but one that provides secluded leisure, rest, repose, meditation and sentimental pleasure. Without knowing this, it is almost impossible to appreciate fully the true significance of the Japanese garden.

A stone garden at Ryoanji temple in Kyoto is perhaps one of the most unusual and unique gardens and has no rival even in Japan. In this garden we see just white sand* on which fifteen rocks are arranged in groups of seven, five, and three. There is nothing else, neither tree nor flower. This is a flat, symbolic garden. It is 75 feet long by 31 feet wide, and is surrounded by an earthern wall. Why does

*The "sand" used in Japanese gardens is crushed stone of a size Western gardeners would consider to be fine gravel.

One of the rock groups showing carefully raked sand.

such a simple garden attract so many visitors throughout the year? Every garden visitor to the old capital, Kyoto, no matter who he is, Japanese or foreigner, visits this stone garden. There must be some reasons for this.

The garden was laid out almost five hundred years ago. No one knows who designed it—it might have been Soami, Muso-kokushi, or some one else, but there is no reliable record left to us. Nor does anyone know for certain the exact purpose behind its planning. However, I am quite certain that this type of Zen temple garden was designed to symbolize and suggest some mental beauty to each one's imagination; not only a reproduction or interpretation of nature, but also deeper thoughts expressed by the rhythmical combination of rocks on white sand. Our ancestors tried to fathom our own world in this vacant space, looking into an unrestricted open area which gives us a feeling of freedom. In this secluded and quiet surrounding, as we gaze at this infinite space, our imagination leads us into an ideal world, which may appear as a wide open sea with several islands or

Side view of another rock group

high peaks, shown above a white cloud where we hear soundless voices or find fragrant blossoms. Let me quote part of a Ryoanji temple periodical:

"When we face this garden and are struck by the calm, pure and noble sincerity of the absolute self, we, the individual egos, have our stained minds purified and get the quality of Buddha, basking in the blessing of our cleansed minds, and this is the zenith of Zen teachings."

To the Zen sect, everything in the world is a figure of God or Buddha and this garden fully expresses the essence of Zen ideas. This is the real reason that this stone garden is a pure, solemn, religious poem—a noble picture and a precious music. It might be interesting to the reader to know an American landscape architect's interpretation of Ryoanji. He visited it a few years ago and when he came back to Tokyo he told me about his impression of this garden. After he sat viewing it for about an hour he began to feel that he could hear some sort of beautiful "soundless sound" among

Priest-gardener raking the sand

these stones. First, in his mind he tried to move the stones and rearrange them in his own way. But there was no way to get a better solution than the well-balanced and harmonious arrangement that is there. He then examined each rock. There was no special beauty in the single stones, but in the grouping as a whole each stone ties together and helps each of the others in a harmonious way, like the members of an orchestra, playing in unison. This is an interesting reaction of an American who had no previous ideas of a stone garden but still found such deep thoughts in this superb example.

Rock and Water

In general, as garden materials, rock and water both are most important. Natural stone plays a very essential part in the garden and certainly our rocks are a strong factor in the total design of Japanese gardens. We treat natural stones as materials which have vital qualities because we feel life and soul in such natural stones, which are frequently used both for idealistic and also for realistic representation in gardens. They express rhythm by their combination. Careful thought and consideration are

given to each rock's relationship to the other materials. In setting rocks in a garden, we almost intuitively know which side to turn to view and also that which bears relevance to the designer's theme. They are variously arranged in combinations of two, three, and five to form groups in the different parts of gardens.

Water is of intrinsic value to the Japanese. It constitutes the chief ornament, because it enlivens and revives the garden, and water is certainly our most nearly indispensable feature. It is held in especially high regard when it moves or makes a sound. But in many gardens in big cities, natural water may not be available, and city water is rather expensive in Japan. So water is symbolized by a technique technically termed "Dry-up water"—a scene in which water is represented by white sand, and sometimes pebbles and occasional rocks, presenting the thought of ocean and islands, or torrents (see page 35). Such an imaginary scene is more strongly expressed when the sand is raked into waved patterns.

On the other hand, since rocks and sand are the most unchangeable of garden materials, they are little trouble to maintain. Furthermore, stones can be placed at almost any place required, even in the shadows of high buildings or trees, or inside rooms.

In viewing a stone garden, even the same group of stones gives us different interesting aspects according to the time: morning, mid-day, evening; or at different seasons of the year. They also change with the weather. For instance: on a cloudy day all stones seem to be lifted up or floating on the sand, but in fine weather they look sunk in the sands. So such differences in appearance must be considered in appreciating this kind of garden.

Study in Black and White

The Ryoanji stone garden may be taken as an interesting study in black and white. Chaste simplicity, refined elegance and tranquil solitude are all included in this monochromatic representation. How nobly is this view in black and white presented by different degrees of intensity in this stone garden! Instead of suggestion by definite color, we have a wider field in monochromatic expression in which the imagination is unconfined and can construct its own rich scenes.

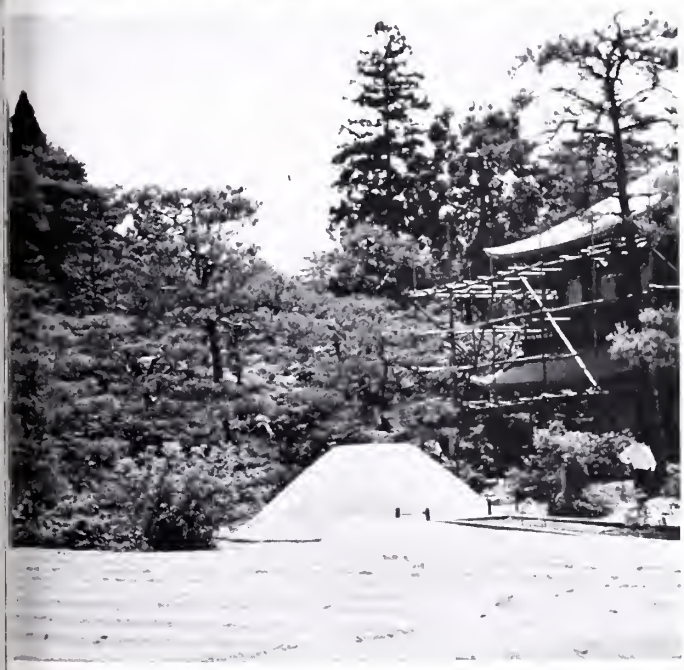
Religious Significance

To a certain extent, the custom of applying a religious meaning to the stone work has been preserved. But of the Ryoanji stone garden I cannot say with confidence whether such thoughts were represented by the fifteen stones or not. Whatever the style of landscape composition might be, some sort of Buddhist meaning must be incorporated, its absence being regarded as most inauspicious. But a wide open space of white sand is not simply left open—the fact that vacancy always stimulates one's imagination and induces the creating of one's own scenery, frees the observer from the artist's dream and permits his own suggestions.

The Japanese attitude toward space is inherent in our deep rapport with nature. It was strengthened by our own nature and perhaps by Zen concepts. Even in such a confined space we can create a vision of a series of continuous spaces going beyond the actual structures. Zen also affirms the reality of moving infinity—the idea that space is the universal medium through which life moves in constant transformation and in which place and time are only relative states. In the stone garden, the extension of these dimensional relationships is by an asymmetrical order which gives the feeling of infinite extendability.

So appreciation of a Japanese garden or any other work of art depends primarily on enjoyment which is stimulated by vacancy. True beauty can be discovered only by one who mentally completes the incomplete. In this sense, the five-hundred-year-old stone garden of Ryoanji still bears out the value of abstraction common to modern art of the present day, consisting in powerful simplicity and based upon the Japanese feeling for nature.

A FEW OUTSTANDING JAPANESE GARDENS



In Murin-an garden, one of the few "grassy" Japanese gardens

Garden of the Silver Pavilion showing one of the ancient piles of white sand

The centuries-old moss garden at Saihoji Temple

An ancient boat serves as a tea house in the Nomura garden in Kyoto

At the Garden of Shisen-lo in Kyoto, Japan, the Tea House faces a sand garden. The sheared azaleas, stone pagoda and weathered rock are among the typical components of traditional Japanese Gardens.

Photos courtesy T. Aoi

The Katsura Palace Garden in Kyoto, Japan, was built early in the 17th Century. This spacious garden includes a lake with three islands, one of which appears in the foreground. The dwarfed pine on the island is typical of Japanese gardens.

The Japanese Garden of the Brooklyn Botanic Garden:

This garden in Brooklyn is a traditional Japanese Landscape Garden, designed and constructed in 1914 1915 by Mr. Takeo Shiota. It was his ambition to make the most beautiful garden in the world. By 1915 he had designed and constructed eight gardens in the vicinity of New York, and his crowning achievement was the one in Brooklyn. All lovers of beauty are indebted to this talented artist who came from Japan in 1907 and lived in New York until his death in 1946.

This garden centers upon a small lake, the outlines of which describe the strokes of the Chinese character *shin*, meaning 'heart' or 'mind.' The lake is fed by a cascade of waterfalls. A small turtle-shaped island is reached by a Drum Bridge. A roofed Waiting-Pavilion faces the lake, and hanging out over the water is a Tea House with adjacent open pavilion.

In the largest section of the lake stands a *Torii* or 'gateway to Heaven.' The Shrine on the hill beyond is dedicated to Inari, the Shinto God of Harvest.

There is a tall pedestal-type stone lantern near the waterfall and a low, broad-roofed 'snow-viewing' lantern on the island.

The principal plants of Japanese origin that are included in this garden are Japanese maples, flowering cherries, azaleas, barberry and flowering quince. Restrained use is made of Japanese irises in small clumps around the lake.

Photo courtesy Bill Schropp

Other views in the Brooklyn Botanic Garden's Japanese Garden. (*Above*) The arched bridge spans the mouth of the basin below the waterfall. The stepping stones are placed irregularly to suggest the flight of wild geese. (*Below*) The corner of the open pavilion is seen over the red maple growing at the edge of the lake. To the left of the 'snow-viewing' lantern, by the island, is the 'waiting stone.'

Yashiroda

250-year old pine trees kept at fixed size along walk in Ritsurin Park, Takamatsu. Trees were originally planted as a shelter for adjacent houses, now gone.

HOW JAPANESE PARK TREES ARE KEPT WITHIN FIXED DIMENSIONS

Nobuichi Kagawa

MY LONG years of practice and observation as a landscape gardener at Ritsurin Park in the city of Takamatsu have convinced me that every tree has a personal character, and wherever it is planted it behaves in accordance with its personality. Therefore, unless one comes to know the individual character intimately, he will not only be unsuccessful in keeping the tree within fixed dimensions for many decades (in this park some pine trees have undergone trimming for 250 years or so), but he may also cause gaps here and there and weaken the tree.

The dominant feature among the trees planted in Ritsurin Park is, as in many Japanese gardens, the Japanese black pine (*Pinus thunbergi*). Therefore I will discuss training it, but the principles are applicable not only to other conifers but to nearly all the kinds of evergreen and deciduous trees grown here.

The majority of Japanese black pines grown in the park are the strain called 'Hyuga' pine, reputed for several centuries to be the finest among the black pines. Even within the 'Hyuga' strain there are many variations, and hardly two alike. It seems that these were raised from seeds, and clonic characters are shown. The noticeable distinctions are differences between individuals in the number and way of sprouting of new shoots around the pruned end of a shoot or about a cut-back shoot; the natural form of the tree; varying degrees of untidiness in growth; the thickness, weeping or upright habit, and durability of shoots,

Yashiroda

Looking up into the branches of the trees pictured on page 45

branches, and trunk; response to fertilizing, and so on. It takes at least several years to learn these peculiarities of a tree even when one keeps notes and continues observation and practice. Even after ten years, mistakes in pruning and cutting-back are plainly seen and can be traced back to their cause. Needless to say, each landscape gardener has his own peculiarities and likings different from others, though they may have grown up and been trained under the same master; so keen eyes can recognize who has trimmed a tree and whether or not it has been trimmed by the same landscape gardener over the successive years.

During the years of growing and trimming to fixed dimensions, one takes pains in the training to meet the tree's individual character and at the same time also to develop the intended shape. It is better to start with young trees whose character will come to be known to the trimmer. Although our park does not add new trees annually, I feel the need of a specially arranged nursery for trimming trees.

Technique of Trimming

The best time for trimming is from October to November, but as there are so many pine trees to be trimmed by a limited number of persons at Ritsurin Park, the trimming is done each year from the end of September until the next June, when young shoots are already quite long.

Removal of the needles. From ten to half the number of needles produced on a shoot in the spring of the year are removed, according to where the shoot is located and its vigor. The higher and further out the position of the shoot, the more needles are removed, so as to admit light to the lower and inner shoots and at the same time control the growth of the upper and outermost shoots. This also allows beneficial rain to reach the inner shoots. Shortening the needles, as practiced in Bonsai training, is not performed on park trees, because the park is open daily to the public and the permanently planted old trees cannot, of course, be removed from the sight of the

Closely-trimmed azaleas are kept in roper scale with the stones and stream in this landscape. Note bonsai on stump in left foreground, and the placing of the lanterns.

Entrance walk to home, showing that closely-clipped shrubs and trees give the effect of tailored neatness as well keeping all elements of the picture in perfect proportion.

Gardener removes outermost buds of pine tree branch that overhangs the gate. This keeps the particular branch constant in size.

visitors while they are unsightly in appearance.

The removed pine needles are useful as *Shiki-Matsuba,* pine needles lying in the garden for ornament and protection (see page 19).

Removal of buds. If terminal and other strong buds are left on the shoots produced during the year, the following spring they will stretch upward and outward, extending the dimensions of the tree. So in case other methods of trimming are not needed or used, only these terminal and some lateral buds are picked off. Nearby latent buds will be thus stimulated to grow, but the shoots they produce will be shorter and more crowded than those the removed buds would have produced.

Pruning. The picture on page 45 shows the largest pines among the trimmed trees at Ritsurin Park. These trees were planted 250 years ago as a shelter when some houses were built here by the order of the feudal lord of Sanuki. Since then these pine trees have been kept to the same size and shape. Generally, pruning and cutting-back keep these large trees in order. Some of these pine trees have been attacked by white ants and hollowed out, but even those that are severely affected have not shown any noticeable weakness. This is because annual pruning stimulates and rejuvenates them and frees them from head pressure. The pruning is done on most of the current tip growth, which should be removed with scissors. Sometimes the current year's growth should be pruned at the two-thirds or half-way point to induce new growth there and to form a lower and more compact crown. Too-crowded growth which may result should be thinned to give more air space and light, and to allow full expansion of the needles on the remaining shoots. The head is pruned more heavily to restrain its growth and to admit light freely to the lower and inner shoots.

Just now we are about to move an 80-year-old pine tree to another place. In such a case, although the tree has been scarcely root-pruned for many years past, there is little fear that any damage or checking might occur as a result of trans-

It is a centuries-old custom to keep low hanging branches of old trees in position by the use of supporting posts.

planting, and very little removal of foliage will be needed. This is a virtue which trees that have been trimmed for many years come to possess. Incidentally, this particular tree has been so trimmed as to remain at a height of 8 feet with a spread of 12 feet.

Cutting back. The illustration on page 46 shows clearly the branches produced on one of the park trees as a result of trimming for over 200 years. The reasons for cutting back are varied: to thin out the branches; to open space for new growth; to shorten branches; to equalize two unbalanced branches; to rejuvenate one or more branches or the whole tree; and to give more widely spread and lower branches on older trees. Among one- to three-year-old branches all over the tree, annual replacement by means of cutting back has been done quite thoroughly. One may wonder, then, why such a winding and crooked tree is formed if cutting back is so often practiced. In the course of many years of such treatment the branches acquire a temper and structure more resistant to senility, decay, natural forces, weather, insects, and diseases; hence, a vigorous tree with winding and crooked branches results.

Supports

When Dr. and Mrs. Avery visited Ritsurin Park they were interested to see many pine trees with their lower branches supported by wood props, as shown in the illustration. This keeps the branches from sagging and declining as they age, and permits extension of the lower branches to relieve an otherwise leggy appearance of the tree. Another purpose, chiefly important in northern Japan, is to prevent snow damage. They are also a safety device for trimmers working on a branch, and for the branch itself. A disadvantage of such support is that the branch comes to lack strength; and the wood on the under side, which would normally develop greater durability and toughness under the weight it bears, scarcely does so.

The waterfalls in this miniature landscape of natural stone and sand give a surprisingly natural effect.

BONSEKI, THE ART OF SAND AND STONE

Kan Yashiroda

SUPPOSE by some magic a person could be transported back to the Azoic age before there was life on earth, or to some lifeless planet, perhaps the things he would feel most intimate with would be the little rocks and sand of all the inanimate surroundings. This feeling of affection seems to me to have created Bonseki, the art of sand and stone.

It is said that the history of Bonseki goes back to the Suiko era (593-627), but the style of Bonseki as it now is was originally formed by Sansai Hosokawa (1563-1645), a feudal lord who had been thoroughly and highly drilled in every aspect of art and literature known in those days. Since then many schools of Bonseki, such as the Hosokawa, Koya, Hino, Sekishu, Enzan and Kiyohara, have been founded. One of the most notable achievements in our age was, certainly, attained by the late Hakuen Katsuno, of the Hosokawa school, who not only revived but refined the art of Bonseki; and his successor, the late Genpo Katsuno who succeeded in creating new styles more appealing to this age, applying in some degree the techniques of the oil-painter to the classical Bonseki.

As you see from the illustrations, Bonseki is an art of sand with which landscapes and seascapes, under the sun or in moonlight, or the masterpieces of the painter, are suggested or reproduced realistically in a small tray or other receptacle. The work is emphasized and becomes varied by adding stones, figures, or other suitable materials.

To begin with, one should know and have the materials and tools for Bonseki

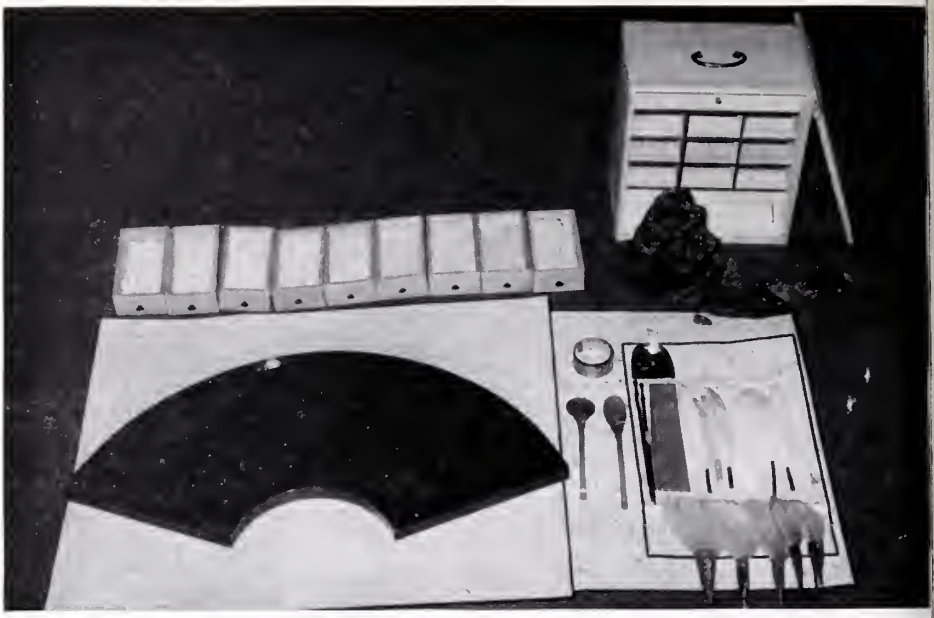
Yashiroda photos

Mrs. Kako Kondo teaches the art of Bonseki as well as the Tea Ceremony. Here she is with her equipment.

making, so here I describe these one by one.

Sands

Naturally produced silver sand is cleaned and sorted and marketed by the silver sand dealer. The sand used for Bonseki is graded into six to nine kinds. Nowadays, in most of the schools, it is divided into nine grades ranging from No. 1, which is the largest and coarsest to No. 9, the most fine and smallest. These



Tools for the Bonseki art: fan-shaped tray, brushes, feathers, spatulas, small round sieve scoop and cabinet (of 9 small drawers) containing different grades of sand, also a few stones. Large bottom drawer of cabinet holds all equipment.

graded sands are kept separate in tiny chests of small, neat drawers specially designed and made to keep the sands and the outfit for Bonseki making.

By dropping or spreading one kind of the silver sand or putting one over another in the tray, mountains, hills, plains, streams, torrents, and natural phenomena such as the sun, moon, stars, clouds and rain, and the sea in calm and rough weather, are formed with a feather or broom or some such appliance.

Sometimes, or in some schools, naturally colored or artificially colored sands are used.

Trays

The standard and most popular tray for Bonseki making is a black-laquered wooden one of oval shape, some 1 to 2 feet long by ½ to 1 foot wide and with a rim some ½-inch high. Besides this, trays in fan, asarum-leaf and corner-cut square shapes, and lacquered boards or such are used. The black-lacquered tray is nicer in harmony and more tasteful than the colored ones which are occasionally used. Trays decorated with gold lacquer on the rim are used at times or the occasion of a happy event, too.

Sieves

To create a landscape in the tray, the different kinds of sand are, according to the subject to be pictured, dropped or spread through a sieve. Also, sieves are used for sorting out the used sands again into the different grades when a Bonseki is to be taken apart.

Nine kinds of sieves are made for sieving the nine kinds of sand respectively. The No. 1 to No. 5 sieves are made for use with No. 1 to No. 5 sands. They consist of small holes in a thin sheet of metal or synthetic material. Fine copper or brass mesh sieves are also used. For

the finer sands (No. 6 to No. 9) generally silk of mesh suitable to each grade is used in the sieves.

Spoons

To ladle sand, to sprinkle it in drawings and to heap it up in the tray, several spoons in different sizes are needed. Some speeially designed spoons for making waves, ripples, trees, and the like have been invented. Such spoons are sometimes looked upon unfavorably because they make the subject too easy and too exact, losing artistic taste and expression.

Chopsticks

Chopsticks are used in picking up and arranging very coarse sand, and removing or changing the place of already arranged very coarse pieces without disturbing the others. Differing from the table chopsticks, the Bonseki chopsticks have notehes toward the tip to make picking-up easy.

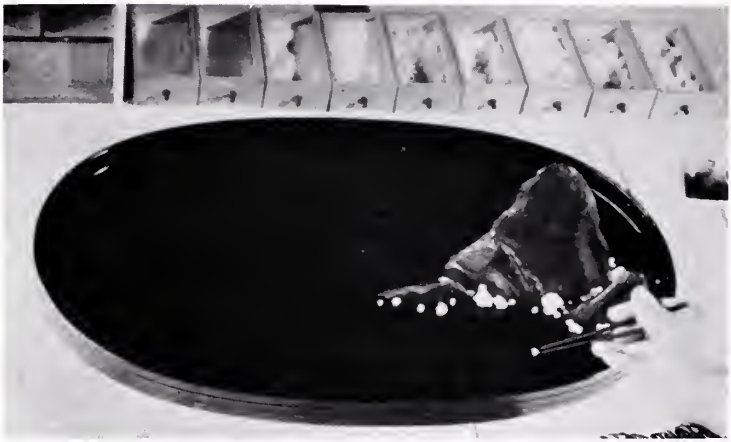
Feathers

Flight feathers (primaries and secondaries) of birds such as swans, hawks and some domestic fowls have a soft, flexible, but almost indestructible surface. Therefore they are a most suitable appliance to make the exquisite lines and forms of waves, swirls, and bubbles in sand, and for other uses in Bonseki. Some treatments are required to make them better for Bonseki, and some feathers specially prepared for certain purposes have been invented, as described below.

Nami-uchi bane or wave-forming feather. A feather having a vane of 3 to 4 inches in length is convenient, so in a longer feather the excess vane is removed. Generally, two feathers are put together and fastened at the quill. Some arrangers prefer to use a wave-forming feather consisting of three or more feathers put together. To express and form waves more exquisitely and finely, tiny

A class in Bonseki

Yashiroda photos



First step in composing a Bonseki is placing the principal stones.

Smaller gravel is arranged around the large stones.

Stiff feather is used to form shore line.

Use of the feather to make clouds, with fine-grained sand

Soft feather is used to make sand waves in the simulated sea.

Finished seascape

Yashiroda photos

Making a Bonsek

notches are cut on the edge of the vane, as on a saw. Wave-forming feathers with specially made notches suitable for arranging billows, ripples, wavelets, swirls, and the like should be prepared. To cut and make the notches in proper shape and size is a delicate operation requiring skill. Therefore, to a Bonseki arranger, it is a most interesting and fascinating work. However, for the beginner a ready-made one is good enough.

Kasumi bane or mist-forming feather. A soft broad-vaned feather is used to form mist. There are, also, various feathers prepared, such as a narrow-vaned feather with strong texture for clearly showing the border of the mist, mountains, or rivers, and a broad-vaned feather for removing surplus sand or cleaning as with a little broom.

Boards

Rectangular wooden boards, ¼ inch thick and some 1 to 2 inches wide by 5 to 8 inches long, are used to arrange the lineal elements of the mist, rain, etc. The sizes vary with the school and individual arranger.

Besides the above, some other convenient appliances have been invented. Patterns clearly cut in the shapes of sun, moon, birds, leaves, flowers, and many other items are now in favor and are used. Some arrangers detest these appliances because they make the items too exactly and mechanically, lacking the delicate lines formed without them.

How to Arrange Bonseki

As a landscape is photographed in monochrome, a Bonseki arranger catches and expresses it in black and white; but unlike a photograph, he reproduces it through the lens of his imagination, and the medium of silver sand and black tray.

Imagine a time when Bonseki was first tried. There might have been only some silver sand and possibly a few tiny stones available for use but that was good enough to carry out one's attempt to form a landscape in a tray or on a board. Certainly, the appliances have later gradually come to use for convenience. As a gardener creates a rock work or landscape in the garden, his motif and ideas are important, but not the implements used. With a fallen feather from a poultry yard or other appliance, or the hand alone, an amount of silver sand could be turned and formed into an intended landscape in a black tray or on a black board—just as a gardener plans and landscapes in a limited space.

It strikes me that there are few persons, if any, in Japan who would bother paying a school fee to learn about Bonsai. On the other hand, there is, I think, no person interested in Bonseki who does not learn at a school. This is because Bonseki has, in the course of centuries

Applying the finishing touches

Yashiroda photos

as have the tea-ceremony, incense-ceremony, and Japanese flower-arrangement, developed strict rules and traditional manners one must learn and acquire. In other words, Bonseki has developed and refined the enjoyment of arranging landscapes with sand and stone into an art of high skill and technique which must be learned one step after another.

I recall a saying that "Seeing is believing!" Really, there is nothing like seeing for oneself. An explanation in words would be confused and complicated to the person who has never seen a Bonseki before. So I asked Mrs. Yuki Katsuno, the head mistress of the Hosokawa school, and she was so kind as to arrange Bonseki for me to photograph. Here it is reproduced step by step.

Here I describe some ways Japanese Bonseki arrangers practice with the outfit I have already mentioned:

As seen in the photographs, a blanket is spread over the floor mats and on it a sheet of white paper is placed in front of the arranger before the black-lacquered tray is put on it. Then, the other things are placed in customary and convenient positions as shown. On the left of the arranger there is the small chest of nine tiny drawers filled with the nine grades of silver sand. These drawers are placed with the coarsest sand on the extreme left as seen by the arranger and the finest sand at the extreme right, the others in order. On the right of the tray, the spoons, chopsticks, boards and feathers for arranging and clearing are placed. The sieves are in the immediate upper position. In the second photograph the mode book of landscapes is opened and the artist is arranging the coarse sand with the chopsticks. Some stones prepared for the Bonseki are placed in front of her. Of course, Bonseki can also be arranged on a table.

When a Bonseki is arranged as the decoration in a room it is considered good taste to select a landscape that matches and harmonizes with the view or landscape outside. For instance, if the outside garden has a pool or pond dominating the view, a landscape with islands or islets, or a stream is preferred. If a woods is in view or the garden is full of flowering plants, a landscape of distant mountains or fields is selected; while for a room surrounded with buildings a rural scene is refreshing. The scenery of the seaside is much appreciated and enjoyed on many occasions.

Whether the alcove, where the Bonseki is exhibited, is a regular one or not is considered in selecting a landscape in Japan. In the photograph on page 51 a picture of tree-peonies in flower is used on one side and that of a beautiful woman on the other. For this alcove a landscape of the mountains, streams, beaches or other peaceful scenes would be

preferred. Anyhow, Bonseki arrangers work to have the landscape match or add to the surroundings inside and out.

To gardeners or garden-minded persons, natural phenomena such as the sun, moon, clouds, rain, rapids, streams, waves, and splashes are interesting and of much concern in larger or smaller degrees to our daily gardening. However, these are things which we could reproduce with difficulty or not at all in our gardens. We rarely meet people who think they can improve on nature. But as we follow nature in planning, planting, and landscaping gardens, we often represent these phenomena symbolically or realistically in gardens with sands, rocks, trees, and flowers. To those who do this, Bonseki is an amusing arrangement and an art to realize their visions of nature as in gardening. It may be called indoor-landscaping.

Representing Natural Phenomena

Patterns clearly cut through in the shape of the full moon or new moon are conveniently used. The pattern is placed on a tray where one desires to make the moon and then the sand is drifted through a sieve to give the form of the moon on the tray. The seasonal differences of the moon should be expressed by the grades and amount of the sand used. Sometimes slightly colored sands are added in some part or other, but that is no improvement nor is it tasteful. The sun is done in the same way. To show the beauty of autumn leaves fallen on the ground in gardens or woods, patterns punched with the shapes of leaves would make a nice scene of autumn, if arranged well. Every member of the Brooklyn Botanic Garden knows the beauty of the fallen petals of the Japanese cherry plantation there. When one recalls this beauty, he can revive it with a handful of slightly pink-tinted sand in a tray or on a board.

The thunder cloud passed by after drenching every thirsty tree and flower in the garden is not only appreciated but impressive. The columns of clouds in summer, the mist veiling the hills, and the varied aspects of the sky are all interesting subjects for Bonseki. The clouds and mist are roughly shaped by sifting No. 8 or the finest sand through the sieve and then arranging it nicely with the feather. In the accompanying photographs, Mrs. Kako Kondo is just finishing some fleeting light clouds with a last touch of a feather. A cloud such as cumulonimbus is better formed by dropping the sand from a roundish spoon, and after that it is well arranged and shaped with the back of the spoon.

We are hardly able to present waves in our gardens or to perpetuate them. But we can do this in Bonseki. Persons who have enjoyed the beauties of green trees and colorful borders, find it pleasing to turn their eyes to a scene of waves in black and white.

Here are four photographs showing how a wave is formed. After the sand is spread in the shape of a wave, the undulation is formed with a broom. Note in the second photograph that a spread of sand at the extreme right in the preceding photograph is arranged into sprays. In the next photograph, the undulation is completed and now the tiny eddys are formed with a broom. The finishing touches are performed with a feather in the last photograph.

The exquisite technique and form for arranging the raging waves, breakers, surfs, backwashes, ripples, whirling waves, waves in a stream, and others are highly developed. Skill and time are needed to master their arrangement.

The stars are arranged by dripping a coarse sand with a spoon from a height of 4 or 5 inches. If the Milky Way is arranged, first the finest sand is dropped in the shape of it and then some coarser sands are dotted on.

As when we construct a rock garden, stepping stones, or a wall for hanging and clasping plants in our gardens, collecting, selecting and setting the stones is ever so fascinating a work. So too in Bonseki. An old Japanese Bonseki book says "A stone suitable as a mountain in the Bonseki is some 7 inches in width, and the height and depth are proportionate to

At right, "The Great Wave," a famous old woodcut with Mt. Fuji in distance. Below, Bonseki reproduction of the woodcut, by Koko Nakamura

the width. A river stone, stable and untreated, is preferable. Such river stones are best. The stones in the mountains are generally too coarse in appearance, while the sea stones are less tasteful, though some nicely shaped ones are found."

Generally, a stone of some 6 to 9 inches wide and 4 to 6 inches high is used. Blackish or grayish stones are mostly selected but stones of varied colors and natures are sometimes preferred just as they might sometimes be selected in gardens. As the primary objective, no more than the two large stones of the size mentioned are arranged as a symbol of mountains, hills, islands or anything else; and some smaller stones are often used as an aid or accent. From books about Bonseki, including *Bonzan Sharo* written in 1592, I learn that there are very many rules and usages on the arrangement, technique, outfits, and materials used. Also, there are rules and manners for the arrangers and appreciators as in the tea ceremony and flower arrangement in Japan. I do not think it essential to go into these here.

In concluding this article, I hope that you will have an occasion to learn a few of the elements of the Japanese way of Bonseki, and at the same time try this indoor landscaping for yourself.

The sun rises on Mt. Fuji and the pines of "Morning in the Shrine Garden," a Bonseki by Haruo Katsuno.

JAPANESE GARDENS AND BONSEKI

—Their Relationship

Yuki Katsuno

STONES are looked upon as more important than trees in Japanese gardens. This might be due to an Oriental aspiration after eternity; an attempt to add an eternal element to the garden as it is found in nature.

Since Bonseki made rapid progress in the Muromachi period (1392-1568), when we think on the relation between Japanese gardens and this art we come to the conclusion that the styles of gardens in that period had great influence on Bonseki. Most of the gardens in the Muromachi period were based on the taste of Zen. This sect came to our country from China in the Kamakura period (1186-1392), becoming popular among the military class. As the Zen priests fondly loved to drink tea, which was a precious article, in time the mental concentration practiced in the Zen sect was combined with the manner of tea drinking and the tea cult was established. In the tea ceremony not only was drinking tea enjoyed, but it became the fashion to appreciate the gardens surrounding the place. Primarily, the true aim of Zen is to calm and concentrate the mind so it can be spiritually awakened. The adoration of Buddhist images is not the main object and therefore the motive for carving and modelling declined. Zen devotees turned to the garden, which is a composition in space. In gardens based on Zen ideas, the interest of a stone itself and the balance between it and the whole garden was more esteemed than the beauty of trees. So the dominating feature in the garden was the stones arranged together, and to them were added neatly trimmed low trees, mosses, and silver sand. Therefore, there remains a commodious space not interfered with by trees, and interpretation of the resultant composition is left to the person who comes to appreciate and meditate. The famous stone garden constructed in those days at the Ryoanji temple is the most noted garden based on Zen ideas. It is

said that the garden is the work of Muso Kokushi (1275-1351), a famous Zen priest, and the idea and much of the form were borrowed from Bonseki. (See also the article on page 50.)

The stone garden at Ryoanji is a small flat one surrounded by an earthen wall. There is neither any accessory nor tree, but only fifteen nice stones arranged in five groups on a space covered with silver sand. It might be called a Bonseki garden. It symbolizes islands with stones and the sea by the sand, all beautifully harmonizing with the space in which it is intentionally and effectively composed.

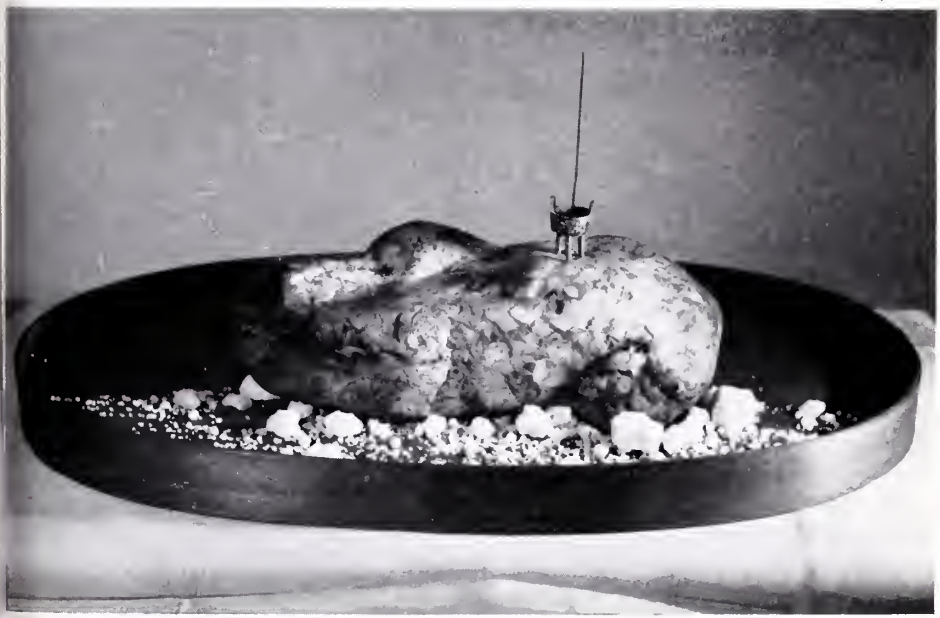
In the same way Bonseki symbolizes islands with stones and the sea with silver sand, the only difference being that Bonseki is presented in a tray, as shown in the illustrations. Such symbolic simplicity is the way of expression we Japanese are so fond of. The picture below is one of my recent works whose way of presentation has been known for hundreds of years as *Ishi-Kazarino-Bon*. On the stone which is surrounded with symbolic features of nature expressed with white gravel and sand, a tiny incense burner is placed. This landscape is created to inspire a feeling of nature.

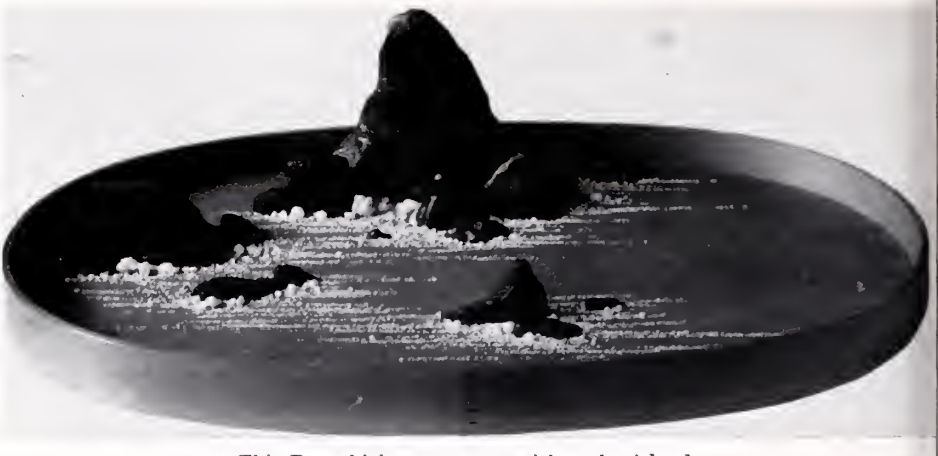
Another composition of Bonseki is shown on page 62. It is entitled "A landscape after Soami's principles of rock arrangement in the garden." I have arranged and formed it following hints from the works of Soami, a noted old classical landscape designer and artist. This Bonseki is constructed on the same basis of composition as that in the stone garden of Ryoanji. (The reciprocal relation of the stones is different from that at the stone garden; however, the Bonseki reminds us strongly of it. —Guest Editor)

Since the Muromachi period, the handling of stones became more and more popular, and the abstract presentation of features in nature by means of stones in gardens advanced. Without water, rivers and streams have been formed only with stones and sand, to give the same effect as water. Mountains and waterfalls have also been represented abstractly with

In this Bonseki, the main component is the unusual stone, on which is placed an incense burner which symbolically purifies the air.

Yashiroda photos





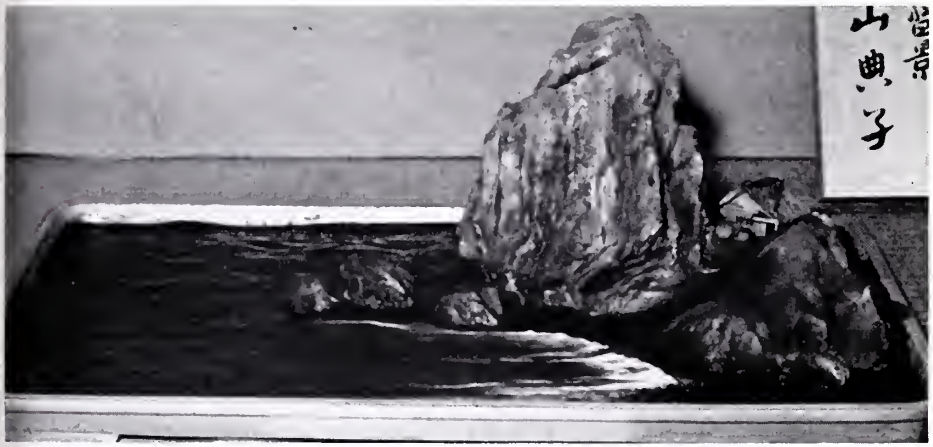
This Bonseki is a seascape with rocky islands.

some suitable stones and sand to make a complete and well-composed garden. Such a garden is called Karesansui or landscape without real water, and is highly appreciated and often constructed in Japan. The most famous masterpieces of Karesansui gardens are to be seen at the Daitokuji and Manjuin temples in Kyoto, as well as at other places. (See illustrations on page 7, 8, and 9.) The abstract arrangements of stones and sand in these gardens are just the same as those we practice and express in our Bonseki. This shows, I think, that such a style of garden has been developed mutually with Bonseki over the centuries. In both, the odd numbers such as 3, 5, and 7 are thought of as lucky numbers. When we make mist, waves, a heaped hill, and groups of stones in classical Bonseki, we arrange them in threes, fives, and sevens. Another motif frequently found in both the gardening and Bonseki arts is Mt. Horai, the legendary happy island of eternal youth. A typical example is shown in the illustration below. Note also the two tiny figures of the white crane, thought to be a bird of luck. This is another motif often used in both arts. (See also page 77.)

Gentle waves wash the shore of this rocky island.

BONKEI, LANDSCAPES IN TRAYS

Bonkei is an art form somewhat more realistic and less abstract than Bonseki, in which landscapes are created in trays in three dimensions and natural color. Special kinds of clay are used to model rocks, mountains, ocean waves, and other elements of a scene. These are painted in natural colors, and powdered moss is sprinkled on to provide the textures of vegetation. Dried plant materials may be used for trees, shrubs, and the like. The composition is usually completed with miniature accessories such as houses, boats, animals, and people. Two fine examples are shown here. In a sense, the garden models on pages 32 and 33 are Bonkei, though they were created as aids in garden planning rather than objects of art in themselves.



This Bonkei portrays a mountain rising steeply from the sea

A Bonkei with low mountains by the sea, and pine hanging from cliff

GARDEN ACCESSORIES

LANTERNS (*also see page 15*)

(*Above*) A few of the thousands of devotional lanterns at Kasuga Shrine, Nara

(*At left*) "Snow-scene" lantern, so-called because it is thought to be most beautiful in winter when the snow is on it.

"Firefly" lantern in Katsura Garden, Kyoto

Very old, moss-covered lanterns at Kasuga Shrine, Nara

Stone lanterns in various styles and sizes

FENCES

Fence of bamboo tied with decorative cords

Detail of fence showing elaborate knots in cords

Various materials are used in construction of fences and garden gates. The gate in this picture is made of cryptomeria bark.

Fence of reeds woven in the Numazu style, named for the resort town in central Japan where it is much used.

(*Below*) Low, open fence of bamboo

CASCADES

"Two-step" cascade

Low cascade designed mainly to produce musical sound of rippling water

(*Left*) "Full-moon" bridge at Korakuen, Tokyo; (*right*), steps and walk of same bridge

Rustic bridge of wood covered with sod; at Sambo-in

An "eight-plank" bridge is especially suitable in woodland garden (*left*) but is also used in more formal gardens (*right*). The zig-zag arrangement necessitates one's turning as bridge is crossed, thus giving views of garden from various directions.

Bridge of one large stone

Four stone blocks make this rustic bridge.

STEPPING STONES AND PATHS

Large stepping stones for crossing water

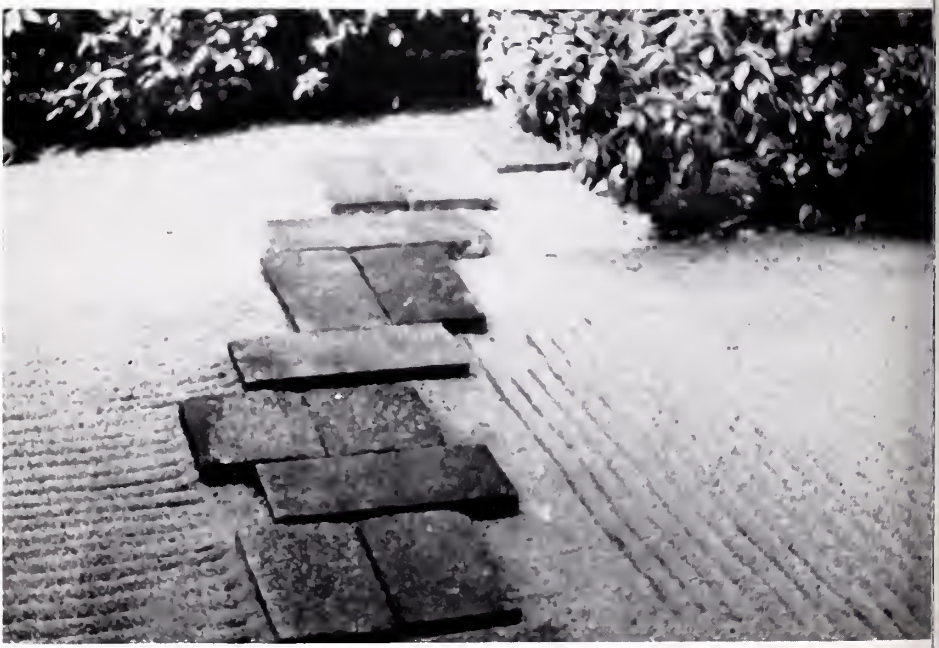
One-time stone bridge posts, used as stepping stones across water

Old mill stones provide for crossing stream at Murin-an

Irregular stepping stones used in a naturalistic garden

Some of the many beautiful stepping stones at Katsura Villa, Kyoto

Square and rectangular stepping stones



Square stones in curved single file

Formal walk of cut stones at Katsura Villa (laid without cement)

Cobble-stone walk
(laid with cement)

Gracefully curved
gravel path

CRANE AND TORTOISE

Buhle

Figures of the Crane and the Tortoise are often used as decorative accessories in Japanese Gardens. It is said that these creatures live longer than any others in Japan. Daily viewing of a garden with the crane and the tortoise insures happiness and longevity!

Rothman

WATER BASINS

Water basins with continually flowing water

Tall water basins are usually placed by verandas from which they can be reached.

Unusual basin at Ryoanji has shape of old Oriental coin.

Basin made in top of large natural rock

Round stone basin is quite typical of those used in tea gardens.

Basin in square or rectangular stone is less frequently seen.

Very large basin carved in flat stone

Ancient ornamental basin of the "dry-water" style

Rothman photos

(*See picture page* 9)

SOME UNIQUE ORNAMENTS FOR GARDENS

Kan Yashiroda

OLD figured tiles in perfect condition, or broken portions of these, are prized for use in the garden—for the religious touch they impart, as novelties to use for paths, border edges, and among rocks, or as unique and impressive accents. The current so-called "revival days" have increased interest in these tiles.

During the last fifteen years, especially in the five or so years just past, many famous castles, temples, five-storied pagodas and other buildings designated as National Treasures or as National Cultural Properties have been reconstructed or repaired in response to the nation-wide enthusiasm for their restoration.

One of the difficult problems in such reconstruction is to have new figured tiles of the same superior quality as the old ones which have endured for centuries; and to have a plastic art tiler who is able to reproduce these faithfully and at the same time with artistic spirit. Very few such tilers and tileries have been authorized by the Japanese government. Mr. Hirakazu Kobayashi, of the Kobayashi Tilery, Funatsu, Himeji-shi, Japan, is one of them. He has just completed and installed all the figured tiles he made for Kumamoto castle, which has been wholly reconstructed in the past several years. The photograph on page 84 shows him making a traditional dolphin to be placed on the top of each gable of this castle. Generally, castle dolphins are reproduced faithfully to the originals, as are the other figured tiles of National Treasures. But this one was an exception. Owing partly to the fact that it was impossible to trace the complete original figure since none remained, Mr. Kobayashi has made idealized castle dolphins for Kumamoto castle, the result of his long years of study of such dolphins all over Japan. Since the war I have been fortunate enough to enjoy and appreciate his dolphins, both reproductions and originals. I have learned that the intense, oriental, humanized form harmonizes with and penetrates into the different tones and delicacies of the green of trees and other gradations in gardens. Once Mr. Kobayashi told me that sometimes when he is on

his wild bird observation trips (he is well known as a field ornithologist) it occurs to him that if his dolphins were set in a natural thicket among the wild life they would look nicer than on a castle.

The originals of the ogre-faced tiles for the ridge-ends of the temple (page 83) were made by Yaroku in 1561; those shown here are Mr. Kobayashi's reproductions. Our ancestors' naive religious sense is expressed pleasingly on the ogres' faces, and the power to drive off evil spirits which the ancient people believed them to have is presented with humor. How charming and jolly to find here and there in the garden one kind or more of these ogre-faces, of which there are many. I myself have such a tile at the foot of a big tree trunk, and it has had many admirers. As caricatures and cartoons in a newspaper, so these tiles can play a pleasant part in our gardens.

The comma-shaped tiles shown below are reproductions of tiles which once roofed the five-storied pagoda at Tennoji temple, Osaka, which is now being restored. Every temple and castle has its own crest or design, so there are endless figures which cause the collector to sigh. The older ones are more than one thousand years old. The dolphins and ogre-faced tiles are made only by hand, but the comma-patterned tiles can be made in molds, so can be mass-produced. Many gardeners use them in their gardens in one way or another. Among other things they are often neatly and artfully converted into containers for moisture-loving plants.

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PLANTS & GARDENS

1961-62

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NEW SERIES
17 No. 4

AMONG THE CONTRIBUTORS TO THIS ISSUE

ELEANOR P. CHALFIN (Mrs. Bruce), Plantation Gardens, Rustburg, Virginia, is well kno for her fine collection of herbs.

JANE B. CHENEY is Director of the Children's Museum of Hartford, Connecticut.

MARTIN COHEN, of Brooklyn, New York, lived for a year in a Zen Temple while studying Japan under the auspices of the William Frederick Dreer Award, presented by the C lege of Agriculture, Cornell University.

DAVID H. ENGEL is a landscape architect, with offices in New York City. He spent seve years in Japan studying on a grant from the Japanese Ministry of Education. He the author of the book "Japanese Gardens for Today," published in 1959 by Charles Tuttle Co., Rutland, Vermont.

MRS. ROBERT A. HACK is a member of the Green Fingers Garden Club, Greenwich, Connec cut. She has exhibited in many flower shows and is especially interested in visiting ga dens when traveling abroad or in this country.

E. C. M. HAES is a contributor to the Gardeners Chronicle (London).

PAUL F. HIGGINS is Senior Forester, Conservation Department of the State of New York.

GEORGE HULL is Garden Editor and chief photographer of the *Chattanooga Times*, Chatt nooga, Tennessee. Mr Hull also contributes to the *New York Times* and national ga den magazines. He is a bonsai enthusiast and an active member of the Brooklyn Botan Garden.

PAUL D. KILBURN is a botanist with the Department of Biology at Principia College, Elsa Illinois.

W. E. MCQUILKIN is Assistant Chief in the Division of Forest Management Research at t Northeastern Forest Experiment Station (U. S. Department of Agriculture), Upp Darby, Pennsylvania.

BERNARD SCHWARTZ is Professor of Law, New York University. He specializes in constit tional and administrative law.

RALPH W. SHERMAN is Chief Staff Officer, Quarantines and Hearings, Plant Quarantine Di sion, Agricultural Research Service, U. S. Department of Agriculture, Washington, D. He is a specialist in foreign and domestic plant quarantines and entomological inform tion.

L. R. STRICKENBERG is Engineer in charge of equipment management at the Eastern R gional office of the U. S. Forest Service in Upper Darby, Pennsylvania.

JERRY T. WALKER is Plant Pathologist, Brooklyn Botanic Garden.

LANDON H. WINCHESTER is Assistant Horticulturist, Brooklyn Botanic Garden.

DONALD WYMAN, Horticulturist of the Arnold Arboretum, Jamaica Plain, Massachusetts, the author of many books and articles, notable among which are "Shrubs and Vines f American Gardens" (Macmillan Co., New York) and "Trees for American Garden (Macmillan). He has been Guest Editor of several Handbooks in the PLANTS & GA DENS series.

PLANTS & GARDENS

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Editorial
PAUL F. FRESE
CAROL H. WOODWARD
and the Editorial Committee of the Brooklyn Botanic Garden

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Bert Beaver, Montreal

Birds in Trees—impression of Eskimo carver who has never seen a tree—*Ittorchiak,* Frobisher Bay, Baffin Island

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES
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The Year-end
1961-62

For this issue of PLANTS & GARDENS, it is our pleasure to present, in condensed form, articles of lasting interest and/or significance that have appeared in other magazines (chiefly gardening and horticultural) during 1961.

This is the seventeenth year that our Editorial Committee has made its annual selection, and we want to thank the authors, editors, and publishers of the original articles for their warm cooperation. As long-time friends of the Botanic Garden know, this annual digest is our way of drawing attention to the "articles-of-the-year"—those with idea- and fact-value that seem worthy of special recognition.

We are sometimes asked if there is a trend in gardening and horticultural articles. Aside from the all-too-rare new discoveries that occasionally stimulate a rash of articles on special subjects, we note only the following: as scientific experiments take the place of gardening dogma, new facts and practices emerge. The articles that start on pages 23, 27 and 38 illustrate this point. But not everything in the gardening and horticultural world lends itself to the scientific approach. There is and always will be the aesthetic side that stems from the heart. As living things that grow where we put them, plants have a special and rather universal appeal. Putting one's roots in, whatever the implication, is no empty phrase. Nor does the beauty that plants give to our lives pass unnoticed. In the garden and as the subject of artistic designs that we find around us in everyday living, plants are the symbols most humans turn to for inspiration. Whether it be designs for wallpaper, silver, fabrics, etc.—all frequently carry the unspoken message of plants.

But to get back to possible trends: there is strong interest these days in the gardens and the horticultural practices of the Japanese. It was nearly fifty years ago that the late Alfred T. White presented a Japanese Garden to the Botanic Garden, and there has been a growing interest in its beauty and symbolism ever since. In the past our garden thinking and design came to us almost entirely from Europe, but we now find writers giving major attention to Japan. The first 16 pages of this issue illustrate and acknowledge this trend.*

Three of the articles included here were written especially for this issue, and a fourth—**THE PLACE** (page 53)—is a child's nature story that it seems to us should be universally read, whether one's age is eight or eighty.

Good reading and good growing in the months ahead.

Sincerely,

George S. Avery

Director

*We are informed that Josiah Conder's classic folio edition of "Landscape Gardening in Japan" (1893) is to appear in an inexpensive edition in 1962 (Dover Publications, 180 Varick St., New York City).

GROWING BONSAI, THE DWARFED POTTED TREES OF JAPAN

Start with larger plants

George Hull

Condensed from *The Chattanooga Times*, June 18 and June 25, 1961*

BONSAI growing, once a secret of the Japanese, basically involves pruning and shaping a plant that may already be bent or stunted by accident or from growing in a crowded nursery row.

The greatest single handicap, I believe, that we in this country see to growing bonsai is the notion that it takes the better part of a lifetime to develop a fine specimen.

The headlines go to the ancient specimens of this art, which is understandable. It is impressive to learn that a potted tree may be 350 years old. That many human generations have taken care of it so long is almost incomprehensible to Americans.

But you do not have to go at it that way. The Japanese themselves frequently do not start the hobby of bonsai growing until they retire. Of course, in that country plants can be bought readily from nurserymen and collectors. Plants are for sale in department stores. You may rent plants, and there are nurseries that will "board" your plants whether you are in town or out.

The Japanese are not always patient, as evidenced by their collecting truly old plants from the wild which may be adapted to container culture—and in one or a few years become superb bonsai. And many nursery-grown trees or shrubs, 8 to 10 years old, become "ancient" by pruning or wiring to quickly achieve the gnarled form of an heirloom.

The truth is that some of the best Japanese bonsai qualities may be achieved almost in a matter of moments, by a little deft pruning and perhaps wiring of a selected nursery-grown plant. This was clearly demonstrated to me when I attended a short course at the Brooklyn Botanic Garden not long ago. The Garden has pioneered in explaining this ancient Japanese art to Americans.

*Copyright, 1961, The Chattanooga Times, Chattanooga, Tenn.

Frank Okamura of Botanic Garden Staff examines a 4-foot nursery-grown Japanese andromeda (*Pieris japonica*) to appraise its potential as a bonsai. Old-looking bark and irregularly growing "trunk" are especially important characteristics

And an art it is. Bonsai (pronounced one-sigh) attempts to communicate feeling, usually the qualities of beauty we admire in gnarled old trees, perhaps distorted by natural forces in their struggle for survival, but still achieving the proportions of grace. Potted trees, less than a foot tall, may suggest all the majesty of a forest giant.

Here is a way to capture, in the palm of one's hand, the beauty of windswept trees along the seacoast, or the feeling aroused by a graceful pine clinging to a rocky crag in one of our mountain landscapes. Bonsai culture uses gardening skills to transmit, in small space, great meanings, like the breadth of sentiment that may be contained in a few verses, or by a painted canvas.

The bonsai demonstration was conducted by Frank Okamura, a staff member and expert who cares for Brooklyn's famous Japanese garden. The plant he used was a 4-foot balled-and-burlapped nursery-grown Japanese andromeda (*Pieris japonica*) estimated at 10 to 15 years old. Within an hour he had reduced the size by half or more, increased the natural grace of the plant, and started it on the first stage of its career as a bonsai.

First he removed the burlap covering on the root ball, and dug away the soil at the top, to reveal the natural spread of the trunk at the base, and any large roots that might contribute to the appearance of the plant. Then he cut away the base of the earth ball, pruning large roots, so the plant would fit into the moderately shallow container.

The type of container selected for bonsai is of particular importance, as it serves in much the same sense as the right frame for a picture. Shallow trays or pots are effective, and their colors are often soft earth shades that harmonize with, rather than dominate the plants. The pots are unglazed inside, and there are drainage holes in the bottom.

Of special interest to most Americans is the potting technique used by the Japanese for bonsai. First, pieces of wire or plastic screening are put over the drainage holes, then gravel and a layer of coarser soil, to guarantee good drainage. With the plant in position, Mr. Okamura demonstrated a technique often needed with larger plants. He drew wires through holes in the base of the pot and tied them tightly over the root ball of the plant (with rubber pads to prevent bruising). These wires keep the plant firmly in the pot until new roots become established.

For healthy growing, in such small containers, the soil must drain efficiently, and still retain moisture. To achieve this kind of granular texture, the Japanese use dry soil. The mixture is sieved to the right size (according to the container size), with special attention paid to sieving out the finest dust-like part of clay soils, as

With the burlap removed and the root system reduced by pruning, the plant fits into an authentic bonsai container. Working with the plant is facilitated by placing it on a lazy Susan

this would cause a compact, brick-like condition. Soil mixtures vary but basically are a combination of sand, leafmold, sieved loam and sometimes clay subsoil.

Potting is done with the dry clay soil mixture which is thoroughly worked into and firmed between the roots with 10- or 12-inch long pieces of small wooden doweling. The Japanese use chopsticks. The solid part of the soil ball should not be disturbed. Finer soil is used to cover the surface, which encourages the growth of moss, a good ground cover for these plants. Of course, after potting with this dry soil, each plant is thoroughly watered without too great delay.

Beauty of form in a bonsai is developed by pruning, and also in many cases by wiring. Anyone who can master pruning roses should be able to cope with training a bonsai. The techniques are not the same, but they are not more difficult.

Mr. Okamura vividly demonstrated how pruning is best done. Study of his original nursery-grown plant to determine the best way to prune, was facilitated by putting it on a lazy Susan so it could be turned easily for observation. The natural curving trunk, exposed roots, and the branching were all considered in determining the "front," or side to be shown when the plant is on display.

Pruning removed practically all the current year's growth. Then the remaining branches were shortened to create informal balance, reveal the trunk, establish a scale from a massive trunk, through larger branches to smaller twiggage at the extremities. Finally, wiring contributed better shape to some branches and filled in the composition.

Mr. Okamura would not claim that his plant was now a finished bonsai by any means and, in fact, a more "finished" appearance might have been achieved in the same time with another kind of plant. But the example effectively illustrates the steps.

In starting with an older plant, such as this, it is highly desirable to pick one with a naturally interesting trunk and basically good branching, since these thicker members are not so easily changed by wiring. After that, the qualities sought are those valued for all bonsai—the proportions that contribute to the impression of a venerable tree, but miniature in stature. Here are some of the characteristics to consider:

Small leaves. These fit into the scale of a small plant, and cultural practices can alter this very little. Plants that usually have little leaves are most desirable for bonsai. Frequently small-leaved variants of common plants—such as small-leaved forms of Japanese maples, or pines with shorter than usual needles—can be found.

A handsome trunk. If the trunk tapers from roots to top, this contributes much. Plants with ancient-appearing bark are favored.

Branch structure. Pruning and wiring can change the shape of branches, but good placement on the trunk is most important. Plants with branches that are almost as thick at the upper end as near the base thwart the illusion of size, but sometimes this may be corrected by cutting back main branches, and training smaller side twigs into terminal growth.

Rootage. Plants with naturally shallow, spreading roots are better adapted to shallow containers. But especially desirable is a structure of roots at the base of the trunk that may be revealed, to suggest the buttressed trunk and surface roots of a really old tree.

Finally, a key point suggested by Mr. Okamura's demonstration, is an opposite action to the usual American habit of growing plants bigger (if not better). That is, a sort of "reverse potting." You start with a moderate-size plant. Perhaps you root-prune it, and grow it in the ground a year or so, to "fatten up" the trunk and main limbs. Then you pot it, in a fairly large container, again root pruning. The next year or so, you repot into a smaller, shallower container.

In a nutshell, maintaining the dwarf stature of a bonsai is done mainly through pruning, the nipping back of new shoots to keep growth within limits. This is balanced by limited space for root growth. But the plants must not become unhealthily stunted. They must always keep

heir growth vigor. Repotting each year, r once every three to five years with ome kinds, gives a chance to root-prune isually about one-third, and replace old oil.

The plant used by Mr. Okamura, after ı year's growth in its new abbreviated 'orm, could be put into a smaller, shal- ower container, which would make for ›etter proportions. New growth soon graces the stubby wired structure. A ruly handsome bonsai develops in a single growing season!

This is a pattern, then, for would-be bonsai growers. Find a plant with attrac- tive leaves, and with a form that you feel you may train into graceful proportions. Pot it in a shallow container, but don't push your luck too hard the first year.

Where do you find suitable plants? All around you. Nurserymen have an increas- ing stock of container-grown plants and balled-and-burlapped shrubs and small trees. These are easy to work with, and many kinds are suitable. You might find plants in your own garden. And, of course, there are wild plants that may be collected, although I dislike suggesting this, because transplanting them usually is so difficult that most of them die.

Care of bonsai is much easier than I thought when I gingerly approached this subject a decade ago. Once-a-day water- ing, or a daily check, and other attentions are no more difficult than growing an African violet or a rubber plant. There is a challenge to the imagination in training the plants. But not the least of the fun is plant hunting, for kinds and individuals to develop.

From an aesthetic standpoint, the secret of bonsai is the same as of any art. No one can teach another to be a Rembrandt. But the fundamentals—and the fun of it—are within the grasp of anyone. Like sketching, you may begin enjoying the art immediately. Within a reasonable time you may have a collection of plants as worthy (and valuable) as any collection—of stamps, antiques, or sculpture.

Much of the top of the plant was removed and some of the branches wired into position, resulting in this characteristic bonsai shape within a single growing season

photos by George Hull

DWARF ROSEMARY AN ELIGIBLE HERB FOR BONSAI

Eleanor P. Chalfin

Condensed from *The Garden Journal*, July-August, 1961*

HAVING always doted on tiny and ancient Oriental things, I became bitten by the bonsai bug when I chanced upon an article about the fad for bonsai in this country. As I am a dedicated gardener with faithful allegiance to herbs, a list of possible plants quickly suggested themselves. Dwarf rosemary (*Rosmarinus officinalis prostratus*) led all the rest and subsequently did not let me down in any way.

My first step was to study an authoritative book on the art of creating, training, and caring for bonsai plants. The advice in *Miniature Trees and Landscapes* by Yuji Yoshimura and Giovanna Halford was simple to follow. I hoped for beginner's luck, since I was not choosing a cranky shrub, a troublesome tree, an ancient or unfamiliar plant, but a tried and true herb. Dwarf rosemary proved a perfect made-to-order plant for the role.

The choosing of a three-year-old, one that would possess the proper patina to play the part and already be container-trained, set the stage. Then I asked myself, "Should it be cascade style, lopped off for a semi-upright, left erect, or have a list to the side?" Semi-upright, slightly slanting seemed to me the right decision.

So with my feeling toward the plant subdued for the nonce, I snipped the first small twig. Before I dared to shear more, I slept on the problem. It was not until I felt sure enough that the judicious clipping began, in which I followed a preconceived pattern by cutting a few branches part way on the plant's left side. Since there are a front and a back to any bonsai, the shearing starts on the least developed side — even a well-rounded, natural specimen usually has one poorer facade. After another interval, when the rosemary showed no ill effects from its amputations, the final shaping was easy and the end in view accomplished: the herb was gracefully leaning in a very Japanese manner.

In spring the potted rosemary was set out on a sunny protected terrace, and the plant generously continued to bloom, with only the short flowerless space in midsummer that is its normal habit. The following fall root-crowding was evident. As I did not have an artistic container, I transplanted it into a larger-sized common clay pot, broader and more squat. Some side roots were first pruned, and the bottom soil was tenderly teased from the ball of earth with chopsticks—a pencil could have been used. My precious pigmy was then supplied with some new soil. During winter the plant was kept in a cool, sunny greenhouse, where it gave many weeks of floriferous performance.

Finally, here are a few quick cultural pointers: outdoor life for the plant as much as possible; a sunny spot at all times; and a pot watcher ("plant-sitter") if you must be away from home so that the watering schedule is not skipped.

Plants may be purchased from a herb nursery or may be started from seeds bought from growers specializing in rare herbs. Seeds of dwarf rosemary germinate more quickly and more easily than do seeds of the common rosemary, *Rosmarinus officinalis.*

*Published by the New York Botanical Garden, Bronx Park, New York 58, N. Y.

Deft pruning and a minimum of wiring have started this plant of common rosemary, dug from the garden, on its way toward becoming an acceptable bonsai

Louis Buhle

THE "SAND GARDENS" OF JAPAN

A GREEN lawn is generally the basic component of any garden in a western country, and some of the gardens of Japan also have lawns. But there are centuries-old "abstract" gardens in Japan in which sand or gravel are used to cover the ground. Gravel is used more frequently, because it can be raked in meaningful patterns.

In constructing the replica of the Ryoanji Temple Stone Garden at Brooklyn Botanic Garden, the gravel problem required a satisfactory solution. Washed gravel cannot satisfactorily be raked into surface patterns. Crushed gravel of uniformly-sized particles can be raked into patterns, but if it is to hold the pattern and at the same time present a satisfactory appearance (texture, light and shadow, etc.), it is necessary to combine two or three sizes of gravel particles.

After several experiments, it was found that poultry grit from the North Carolina Granite Corporation, Mt. Airy, N. C., came closest to giving the effect obtained by the Japanese in their Ryoanji Garden in Kyoto.

Of the many size combinations we tested, one of the best proved to be:

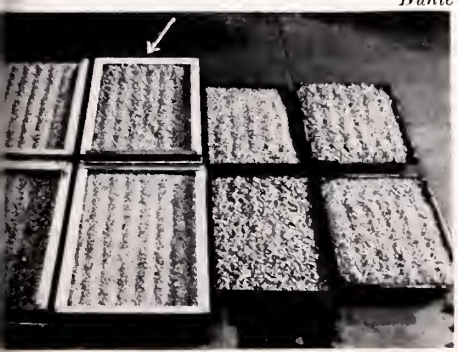
2 parts "Grower" size
1 part "Turkey" size
1 part "Turkey Finisher."

The different sizes were thoroughly mixed, applied evenly over a flat surface, and raked into the "wavelet" pattern shown below.

The mixture can be recommended both for texture and holding quality. The wavelet pattern holds its form for several weeks, depending upon the weather.

While mixtures with a higher percentage of small grit held the pattern very satisfactorily, they were chalky in appearance and did not resemble the original Ryoanji mix.—Landon H. Winchester

Buhle



Eight of the different grit mixtures tested, after months of weathering (see text above). Box containing the best mixture is marked with an arrow

Akio Kawasumi, Tokyo

The charming landscape design of this patio of a contemporary Japanese home is deceptively simple. Gravel under the roof overhang, and studied placing of carefully selected stepping stones and other rocks, are the keys to the layout. The limited grass area, low-trimmed azaleas and trees sparsely used comprise the only plant material. Note the stone lantern and "cloud"-pruned Japanese holly reflected in the window

HOW TO BE AN ARTIST WITH ROCKS AND GRAVEL

David H. Engel

Reprinted from *House Beautiful*, April, 1961

ROCKS, gravel, and cut stone are available everywhere. They are the durable materials with which you can introluce a fourth dimension of strength and timelessness into your garden. Rocks can act as links between house, garden, and the site itself. They are akin to the anchor bolts of the foundation of a building. This is the most basic use of rock and gravel, though perhaps the least obvious. What is obvious is the design and decorative qualities residing in these strong materials. They are honest, straightforward, unadorned, completely natural, and without affectation or pretense. When you look at rocks and gravel, you know that what you see on the surface also runs through to the very heart of the material. This in itself is reassuring.

Since rocks and gravel are not growing materials, they may be used in areas of extreme conditions—too much or too little light, heat, or moisture. But do not be fooled—though they do not grow, rocks and gravel do have a life of their own. They react better or worse under specific conditions. For example, the Japanese warn that rocks put under very large-leaf shrubs will "sour and die" because of too much shade. I would add that neither could they be seen under such conditions. On the other hand, rocks, gravel, and stone pavements are most beautiful and freshest when they are wet so that sunlight, moonlight, or artificial illumination form sparkling glints in the drops of moisture and tiny pools on their surfaces. That is why in the Orient rocks, gravel and stone pavements of a garden are always watered just before the arrival of guests.

There can be no hard and fast rules for composing rocks into an interesting grouping since no two rocks are the same. Generally, anyone with a feeling for artistic composition who understands the universal principles of balance, harmony, and contrast can arrange rocks successfully. Each solution may be different and yet equally pleasing. There are certain general suggestions, however, which should be followed. Rocks should look stable and well set and not as if they would fall over or be easily kicked aside or moved. The long axis of a rock should be either vertical or horizontal (parallel or perpendicular to the force of gravity) and not at some oblique angle which imparts a leaning, unstable feeling. In any one grouping, rocks should neither be all standing up nor all lying down, but rather there should be contrasting vertical and horizontal rocks. Natural rocks of asymmetrical shape should be arranged in a balanced but asymmetrically composed grouping.

Use rocks with weathered surfaces showing the patina of their age. They are the rocks that have lain on top of the ground for many years exposed to the elements. Rocks dug out of the ground or recently cut do not have weathered textures and colors.

In selecting rocks for your garden you should first plan carefully how they are to be used. If they are to serve as natural sculpture in a composed grouping they should have body and girth in three dimensions and they should all have a general similarity of color or texture so that when they are set into the garden they will appear to belong to each other in some kind of natural unity.

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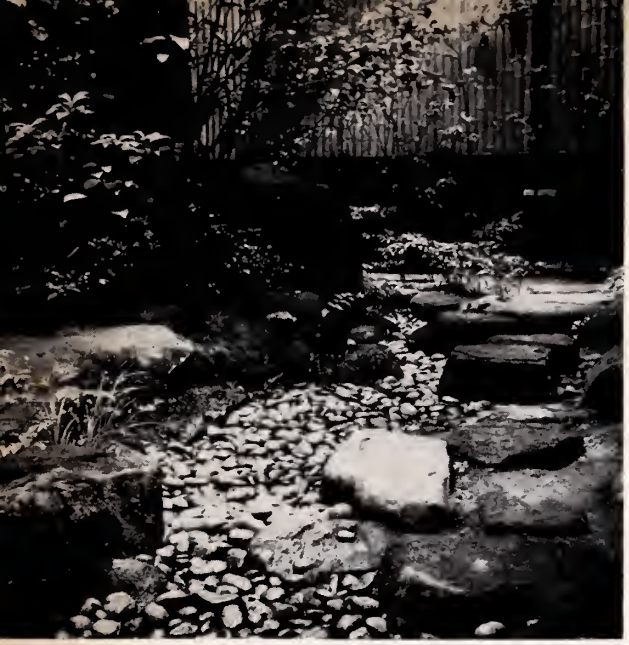


Though this narrow Roji garden is in downtown Tokyo, it conveys the feeling of a rocky stream in a shady woodland dell. To create this atmosphere, rocks and stepping stones are set deeply into the ground. The winding stream bed is of water-washed stones, and gives the feeling of having gone dry only yesterday. Shade-tolerant plants are strategically placed to more or less mask adjacent buildings

M. Kondo

Rocks should not be placed on the surface of the ground but should be partially sunk, leaving exposed only that portion of the rock which you wish to show. Rocks should seem almost to be growing out of the ground.

Some rocks are more desirable than others. In general, hard granitic rocks are better than soft shales, slates, tufa (laval), limestone, and sandstone. The former are older, metamorphic rocks which were subjected to such great heat and compression millions of years ago that their very crystalline structure was changed to a most durable, hard composition. The less desirable rocks mentioned above are relatively younger, softer, easily broken, frangible, and friable, often thin and flat with layers easily split. Aside from structural reasons, granitic rocks are also preferable because they are the rocks that weather best and have the greatest variety of shapes with the most interesting and pleasing textures and colors. The one disadvantage is their heavy weight which may make them difficult to handle.

Rocks may play the starring roles in your garden, but ground covers of loose gravel can become equally strong.

In selecting the gravel most suitable for your garden you should first consider how it will be used. Ask yourself whether it will be walked on very much or hardly at all. You must then consider its scale the size of the particles in relation to other rocks and to the size of the garden itself; and then its texture and color, depending upon how much contrast is desired between the gravel ground cover and the other surrounding elements.

It is wise to consider how much reflection is desirable. Thus, in a dark, shady area, where maximum light is wanted, a white or off-white gravel will do well. On the other hand, if reflected glare from too much light is to be avoided, you should then avoid using gravels such as white marble chips. I would also warn against using marble chips around acid-loving ericaceous plants such as azaleas, laurels, and andromedas.

There are many different types of gravel varying according to their composition and the areas from which they are taken. Sea gravel and river gravel are rounded pebbles in tones of white, off-white, beige, gray, and black, sold washed or unwashed and in various sizes from

screenings of grits 1/16″ to ⅛″ to pebbles ¼″ to ½″; ½″ to 1″; and 1″ to 1½″.

Bank run gravel is of glacial moraine or eroded old river deposits. It usually contains pebbles in a mixture of unsorted sizes and colors, some rounded and others sharp and angular.

Another gravel—which is beautiful though in the United States rather costly—is a smooth, flat, oval-to-round, black-to-dark-gray argillaceous pebble. It is being imported in large quantities from Japan into the United States. It is known in Japan as "Nachiguro." This gravel is elegant and especially attractive when wet.

Gravel composed of small, angular particles is sometimes referred to as "rotten-stone." It is naturally decomposed, semi-granitic, easily crushed and crumbled. It is generally found at the foot of a cliff in a talus slope where it has fallen from the face of the cliff, particle by particle, over the centuries of frost and weathering. The colors vary from brown to beige to off-white. In Japan an off-white type of 1/16″ to ⅛″ granule is used in gardens as a ground cover, especially in the famous "rock and sand" gardens of Kyoto. This gravel is called "Hakusha."

Perhaps the least desirable gravels are the various mechanically crushed rocks—granites, limestones, and marbles—which form angular, sharp-edged chips in several size screenings. There is something brutal and ungentle about this crushed stone gravel. Its uses are mainly industrial. But crushed stone may serve as inexpensive ground covers in large spaces where other gravels would be too costly. One additional advantage is that crushed stone compacts better than rounded pebbles and so is more serviceable in driveways and paths.

Rock and gravel used together become vital structural elements of a garden. In planning their use you must consider all relationships and contrasts of scale, shapes, colors, and textures.

One last warning: rock, stone, and gravel alone do not make a garden. Growing plant life of some kind, even though kept to a minimum, is still an absolutely essential ingredient. Even though it be only a small, delicate slip of a plant in a pot, a low fern, a single strand of ivy, a patch of moss, or a tiny desert cactus, it is this necessary complement to rock and gravel which brings the garden to life. One without the other would seem something less than whole.

The strong vertical lines of tall rocks solidly set in the earth serve in part to screen the hose bib from view from the main part of the terrace. Gravel between rocks gives the composition stability and also discourages weeds

Ezra Stoller

Lanterns of varied designs and materials are to be seen in many gardens in Japan. These are in the Kusudo garden in Kurashiki

The texture and pattern of lotus leaf and bud contribute to the designed-by-nature feeling in Japanese gardens

THE APPRECIATION OF JAPANESE GARDENS

Philosophical ideas that may well apply to our garden thinking

Martin Cohen

ALTHOUGH the design of many Japanese gardens has been derived from Buddhist symbolism, there are also influences from other aspects of Japanese culture, such as the tea ceremony. It seems fair to say that the majority of Japanese judge and appreciate gardens by the atmosphere created. This thought is difficult to pinpoint, but if we consider the manner of appreciation and interpretation of gardens by Japanese people, we can not only learn about Japanese gardens, but perhaps also learn how the philosophy of the Japanese can be applied to our gardens in the western world.

The Japanese attitude toward Nature is of basic importance. Due to the combined influence of imported Buddhism and native Shinto, no division between man and Nature is considered to exist. When Japanese people consider the triad of man-heaven-earth, positive relationships rather than differences between the three are implied. In everyday living, the closest approach that most Japanese have to Nature is their contact with home gardens, although flower arrangement, bonsai culture, landscape painting and Nature poetry are also important. Virtually all private homes are surrounded by a wall or fence, and the open nature of Japanese home architecture makes gardens seem an

extension of the house. All this helps to increase the appreciation of the gardens of others and the many famous temple gardens.

In Japan, the appreciation of both Nature in general and gardens in particular is linked with poetry and romance. The same feeling is echoed even in the Japanese language and in many *haiku* poems, each of which must include a word indicating the season the poem is describing. There is a definite sensuous aspect to maple-leaf viewing, moon-viewing and insect-hearing parties, and approaching gardens in the rain or moonlight. This emotional appeal is much more popular than the intellectual appeal of Buddhist-inspired symbolism, although both are significant.

Another appealing feature of Japanese gardens lies in the concept of association-of-ideas (*renso*) which is also a feature of *haiku* poetry. The idea behind this, as well as that which is left to the imagination in Japanese paintings and poetry, is that appreciation through intellectual participation is more difficult than simple perception, but also more rewarding.

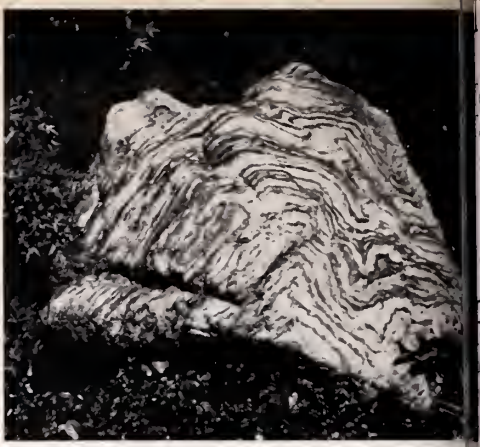
One of the most remarkable characteristics of the Japanese people is their sensitivity of perception in viewing their gardens. The forms of carefully trained pines, the color and pattern of moss, markings of stones, the exposed grain of wood in garden structures, the sound of the wind in pine or bamboo groves as well as the sound of water, never escape notice.

It is possible to find many representations of mountains and water in Japanese gardens. The sensitive person may view rocks or artificial hills or pruned shrubs as representing mountains, while areas of white gravel or moss may be considered to represent the sea. This is appropriate in that the Japanese word for landscape, *sansui*, is composed of the two Chinese characters for mountain (*san*) and water (*sui*). One aspect of the appreciation of the Ryoanji Stone Garden may be based upon this approach.

The simplicity of the design and arrangement of the path, steps and wall in the garden of the Golden Pavilion gives the composition fluid lines

Author photos

Patterns and textures of plants selected for a Japanese garden, such as those of bamboo foliage, have a sensuous appeal



Cherished in Japan are stones with distinctive markings, such as this one at the pond-side in Murin-an garden, in Kyoto

There is very little chance that we will become so poetic in our appreciation of American gardens, but the Japanese do have a lesson for us. If we can learn to be more sensitive to the changing aspects of Nature, as well as its wonder and variety, our gardens will become more meaningful.

We need not look only to Japanese sources for inspiration, because Americans such as the painter Winslow Homer, writers Henry Thoreau and Joseph Wood Krutch, poet William Cullen Bryant, and writer and botanist Liberty Hyde Bailey have already pointed the way

BILLBOARD ZONING IN JAPAN

TO prevent the erection of outdoor advertisements which disfigure urban beauty and the natural landscape, and which might endanger passers-by, there is in Tokyo the Metropolitan Ordinance of Outdoor Advertisements enacted in 1949.

Objects controlled by this ordinance include all kinds of outdoor advertisements, from a huge neon sign on the roof of a building to a handbill on a wall.

By this ordinance, no outdoor advertisement can be placed in specific areas, such as parks and landscape zones, and on specific things, such as bridges, monuments and important cultural assets. Outdoor advertisements are excluded from a greater part of the metropolitan area, except in limited areas.

In recent years, however, unsightly advertisements have increased greatly in streets and scenic zones, evading the meshes of the ordinance. To wipe out such advertisements, the Tokyo Metropolitan Government recently has made a five-year plan, setting the goal at 1964, the year of the opening of the Tokyo Olympics.

It was decided that outdoor advertisements standing along railways and trunk roads which run through scenic zones should be removed or restricted within the fiscal year ending March 31, 1961. In the second year, station squares will be rid of exciting and gaudily colored outdoor advertisements. Beginning the third year a strong city beautification drive against such advertisements will be pushed forward. — Reprinted from the *Tokyo Municipal News,* March, 1960.

THE FORSYTHIA STORY

Today's finest hybrids trace their ancestry to two Chinese species first cultivated in the West over a century ago

Donald Wyman

Condensed from *Arnoldia*, the Arnold Arboretum, Jamaica Plain, Mass.

Forsythia suspensa sieboldii was the first forsythia introduced into Europe from the Orient, going to Holland in 1833. Unquestionably it was popular for here was a new plant with brilliant yellow blossoms each spring, always dependable. It was soon learned that in good soil it would have more blossoms than in poor soil, but even when conditions were difficult, it would grow into an interesting, green-leaved bush which was not susceptible to serious inroads from insect or disease pests.

Soon after this, in 1844, *Forsythia viridissima* was brought from China by Robert Fortune.

Other species introduced since then have not contributed much to the beautiful cultivars we grow today. The European forsythia of Albania is not outstanding and was not even "discovered" until 1897. Two years later it was introduced into England. *F. giraldiana* was not introduced from China until 1914.

Korea is the homeland of *Forsythia ovata* (introduced to America by E. H. Wilson of the Arnold Arboretum in 1918), as well as *F. virdissima koreana* (introduced in 1917) and *F. japonica saxatilis* (introduced in 1924). Although most of these probably have been grown in Japan for centuries, *F. japonica* is the only species native to that country. None is native in North America. So the two introduced species growing in Europe by 1850 (*suspensa* and *viridissima*) can be considered the "ancestors" of the many cultivars we are growing today. Undoubtedly these two species were grown side by side in several places and, of course, eventually had the opportunity to hybridize.

The great Späth Nurseries in Berlin, Germany, was the first to become interested in growing seedlings. Seeds were collected from plants which obviously had an opportunity to hybridize naturally, and in 1885 the hybrid species *Forsythia intermedia* was described. Seedling selections were made by Späth and several were introduced. These were more upright and vigorous in growth than was the arching *F. suspensa*, and several of the new hybrids produced larger flowers more profusely. Also, some clones were selected because they had lighter (or darker) yellow flowers than had been noted before.

Because these plants grew rapidly and were easily propagated by cuttings, they were widely distributed, and some have been popular ever since.

The parade of "new" varieties started in 1899 with the introduction of 'Vitellina' by the Späth Nurseries. This is not one of the best for ornamental purposes in modern gardens. It was quickly followed by the introduction of 'Densiflora' by Späth in 1899, long a popular plant, which is now superseded by others. Two years later 'Decipiens,' a poor-flowered clone of *Forsythia suspensa*, originated at Späth's, but it never proved popular.

However, in 1906 this same nursery introduced *Forsythia intermedia* 'Spectabilis' which became extremely popular right from the start, and has been so to the present time. For a profuse display of deep golden yellow flowers, this is the one that any new cultivar has to beat when it comes to critical comparisons. Never before had any forsythia produced so many or such deep-colored flowers as did this new hybrid. Another selection of *F. suspensa* named 'Pallida' appeared in Germany in 1906 and merited some attention at the time be-

cause the flowers were a much lighter color than those of 'Spectabilis.'

During the ensuing years, these forsythias were, of course, being grown in the United States, and in the Arnold Arboretum an attempt was made to grow them all. There, about 1912, a new seedling was found and later named 'Primulina.' This was another cross between *Forsythia suspensa* and *F. viridissima* and was appropriately named because of its pale yellow flowers. Many liked it, especially those who did not prefer the strikingly brazen yellow of 'Spectabilis.'

In Mentor, Ohio, a suburb of Cleveland, a gardener of some note, M. H. Horvath, had been growing new seedlings, selecting some and discarding others. In his garden was a plant of 'Primulina' which he watched carefully from year to year. In 1930 he noted that one branch consistently produced larger flowers than those on the rest of the bush, and they were more densely arranged. Cuttings were taken, producing plants that were superior to 'Primulina.' About 1942 this was introduced by Wayside Gardens of Mentor, Ohio, as 'Spring Glory,' a plant that has been one of the most popular of all forsythias ever since.

The forsythia story continued on the other side of the Atlantic, in a beautiful garden called Lynwood in northern Ireland, where the owner, Miss Adair, was growing, among other things, a plant of *Forsythia* 'Spectabilis.' Miss Adair noted that a branch of this plant had flowers that were more open and better distributed along the stem than were those of the rest of the plant. Cuttings were taken and grown by the Slieve Donard Nursery of Newcastle, Ireland, and named 'Lynwood' about 1935 in honor of the estate where it originated. Unfortunately, in the early years it was not properly described, and somehow or other, by 1949 when it had reached America, the name was changed to 'Lynwood Gold.' The plants are the same. This cultivar is known all over England as 'Lynwood,' and in America as 'Lynwood Gold.' It, too, is one of the most popular forsythias at the present time.

About 1939, an extremely dwarf forsythia was found at the New York Botanical Garden. This was named *Forsythia viridissima* 'Bronxensis' by T. H Everett in 1947. It was early to bloom, but difficult to propagate and grow properly, an unfortunate characteristic since all forsythias are considered easy to grow.

At the same time Dr. Karl Sax of the Arnold Arboretum became interested in the *Forsythia* clan and started treating some plants with colchicine and hybridizing others. Many seedlings were grown; a few have been named.

'Arnold Giant' was produced by treating a seedling of *Forsythia intermedia* with colchicine. The resulting plant was a tetraploid, but it was unfortunate that it was ever named and released. Although vigorous, it proved too rigidly upright and was hard to propagate by cuttings. Two years later, in 1941, a very dwarf forsythia was produced as a cross between *F. intermedia* and *F. japonica*. This roots extremely easily, makes an excellent plant for banks and is now widely available. It was named 'Arnold Dwarf.'

More crossing by Dr. Sax and his students brought to light another seedling, a cross between 'Arnold Giant' and *Forsythia ovata*. This was a triploid, first called 'Farrand' by Dr. Sax and later changed to 'Beatrix Farrand' at the request of Mrs. Beatrix Farrand, for whom it was named. This produces dense clusters of flowers, is upright and dense in habit, slightly darker in flower than 'Spectablis' under some conditions, and now widely popular. During these years, several seedlings were sent out for trial by the Arboretum and one, which was a cross between 'Arnold Giant' and an unknown forsythia, proved to be a tetraploid and was noted as being hardier in the Mid-west. This was named 'Karl Sax' by Dr. J. L. Thomas of the Arnold Arboretum for Dr. Sax, who originated it.

The Swiss nursery firm of Mertens and Nussbaumer named 'Mertensiana' in 1949, but it has not proved a very desirable ornamental. A variegated form of *Forsythia viridissima* originated in England some time before 1951 and a more ornamental cultivar of *F. suspensa atrocaulis* was selected and named 'Nyman's Variety' in

1954, in honor of the beautiful estate in the south of England where it originated.

Undoubtedly yellow-leaved plants have appeared in the past, most of them suffering severely when exposed to full sunlight, but the one which has been named *F. intermedia* 'Aurea' (1958) was found in a garden near the Beardslee Nurseries of Perry, Ohio.

And so it is seen how two species, *Forsythia suspensa* and *F. viridissima,* introduced into Europe from China before 1850, have been largely responsible for the best of the forsythias grown today.

Forsythia—Brooklyn's Official Flower

For 23 years, Forsythia has been the official flower of New York's Borough of Brooklyn. It was chosen by the late Mrs. Edward C. Blum, to symbolize brotherhood, unity and understanding. Each year since that time, the Borough President has proclaimed Forsythia Day at the Botanic Garden in a public celebration at which the annual Forsythia Award is presented to an individual who best exemplifies the Forsythia creed. Over the years, thousands of Forsythia plants have been given to Garden members in Brooklyn for community beautification. Brooklyn is now famous nationally for its spring show of golden blossoms.

CUSTOM BUDDING OF OLD ROSES

Condensed from the *American Rose Magazine*, July, 1961

PLANTS of old varieties of roses, no longer in commerce, may now be obtained by means of a "custom budding" service, set up by the Old Rose Committee of the American Rose Society. Persons wishing to avail themselves of this service must furnish the budwood to growers. Or, through the committee's chairman, one may obtain the name of a member who has a wanted rose from whom budwood may be obtained.

The following nurseries will do custom budding of non-patented varieties:

Stocking Rose Nursery, Mabury Road at Capitol Avenue, San Jose 27, Calif.

Rover Ranch Nursery, Route 1, Box 333, Wilsonville, Oregon.

Joseph J. Kern Rose Nursery, Box 33, Mentor, Ohio.

Stocking Rose Nursery will accept budwood May through August. River Ranch Nursery wants the budwood from July 1 to August 15. Joseph J. Kern Rose Nursery wants the budwood from July 5 to August 20.

The price is $4.00 a plant with payment in advance. Custom budding is a special service, with more bookkeeping and individual work for the nurseryman, and the $4.00 charge is in keeping with the extra labor involved.

Budwood should not be cut until after the flower has faded and the petals dropped or shriveled. Cut the budwood from the middle section of a lateral and send at least twice the number of buds or eyes as plants desired. The thorns should be left on and the leaves cut off, but leave the stipule to protect the bud. The pieces of budwood should be laid out on damp, but not soaking wet newspaper and rolled up so that they are not more than one layer deep in the paper. The roll of budwood should be slipped into a polyethelene bag to hold the moisture and then packed in cardboard or several layers of dry newspapers to protect it from being bruised in transit. Air mail should be used over a long distance, but parcel post will do within a 1,000 mile radius.

Letters of inquiry should be sent to Victor K. Langford, Chairman, 203 Pine St., Vincennes, Ind.

Published by the American Rose Society, Inc., Columbus, Ohio

FOREST LANDOWNER —A CASE HISTORY

Paul F. Higgins

Reprinted from *The Conservationist*, August-September, 1961*

THIS story began about twenty-five years ago when Merle C. Hale of Detroit, Michigan, decided to buy a parcel of land in the Bristol Hills section of western New York's Ontario County. A place of eventual retirement, aesthetic values and close access to Rochester were chief considerations in his choice of location. A part of the land was wooded, but other than the fact that this looked nice from the distance, the woodland was not an important factor in Hale's choice of the property.

The transaction completed, the new owner set about building a home and making other improvements. Ten years rolled by before he decided to do something about his woodlands. There was a considerable acreage of natural woodlands, about 25 acres of established plantations and numerous abandoned fields suitable for reforestation.

The condition of the natural woodlands was not good. Like so much of our land in the State, a series of logging operations in past years had high-graded the timber stand—taking only the best—leaving the large, defective, poorly-formed trees. The plantations on Mr. Hale's property were in fairly good condition except for some insect damage in the white pine.

To find out what should be done with these woodlands, Mr. Hale contacted the Conservation Department's District Forester's office. He learned that through the passage of the Forest Practice Act of 1946 he could receive the services and advice of a technically trained Forester free of charge. As a consequence of this call a Forester called upon Hale and made an inspection of the property, followed by recommendations on what course of action should be taken. Recognizing Hale's real interest in doing something with his woodlands, the Forester urged him to sign up under New York's Forest Practice Act program.

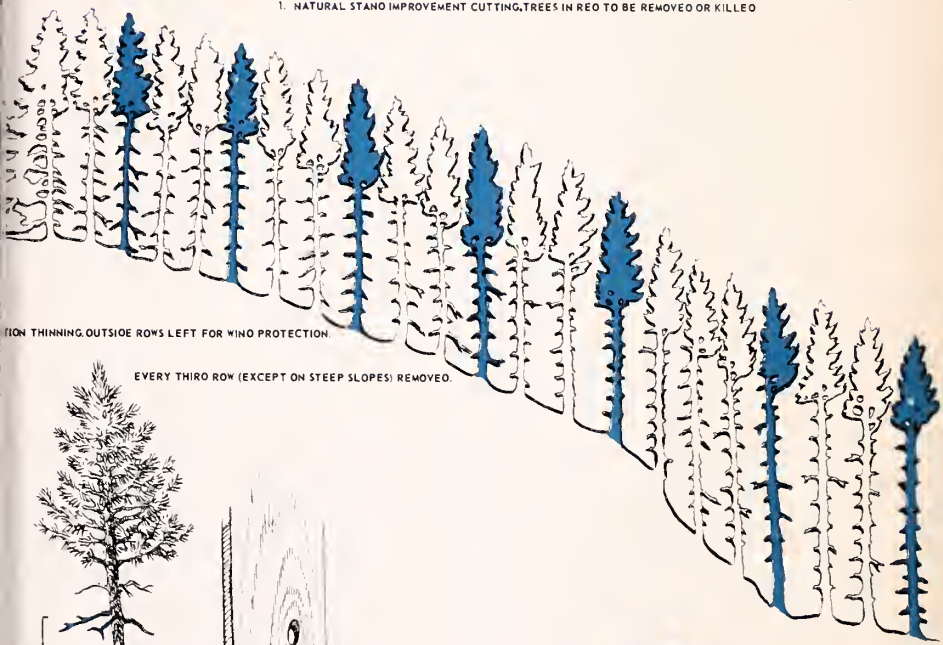
This first step of placing his land under proper forest management was taken. The Forester now prepared a management plan covering the woodlands, recommending actions that should be taken to place them in good growing condition. The original plan covered a period of ten years and has since been brought up to date.

The first woodland improvement operation took place in the plantations that were already established. These stands had reached a size where there was serious over-crowding. Mr. Hale had three plantations which needed thinning, one of white pine, the other two of red pine. It was decided by the Forester that the white pine should be selectively thinned, because, as in the case of so many white pine stands, the area had been weeviled. Since this would be a non-commercial type of operation, it was decided it could be best accomplished by poisoning the poor trees rather than cutting them down. The Forester marked the stand for improvement so that the owner would know exactly which trees should be killed. This operation was completed five years ago and the stand has already shown excellent response. The increase in diameter growth is especially apparent.

There were two red pine plantations that needed thinning, one of about three acres and the other of approximately 12

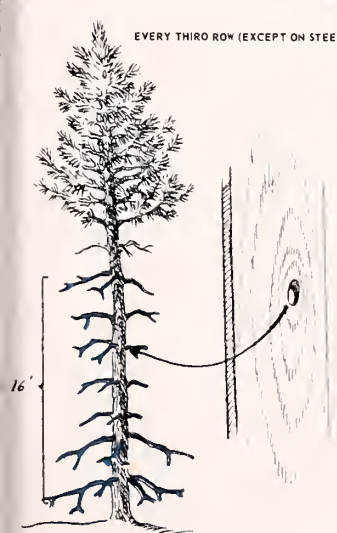
*Published by the New York State Conservation Department, Albany, N. Y.

1. NATURAL STAND IMPROVEMENT CUTTING. TREES IN RED TO BE REMOVED OR KILLED



TION THINNING. OUTSIDE ROWS LEFT FOR WIND PROTECTION.

EVERY THIRD ROW (EXCEPT ON STEEP SLOPES) REMOVED.



N RED PRUNED TO HEIGHT OF 12-16 FEET. UNPRUNED TREES PRODUCE KNOTTY LUMBER.

4. BRANCHES SAWED CLOSE TO TRUNK. AXE PRUNING USUALLY LEAVES UNEVEN STUBS.

acres. The smaller area was selectively thinned, using the cut material, treated with a preservative, to build a rustic fence around the house.

The other red pine plantation was thinned commercially. This plantation was as over-crowded as the white pine, the big difference being that practically all the trees were straight and of good form and of uniform size. It was decided in this particular thinning that every third row could be removed (see illustration no. 2). This method opens up at least one side of the remaining trees, providing room to grow and adequate sunlight. The removal of these stems also cuts down on root competition which is important in the growth of trees. Trees, like any other crop, are subject to competition both above the ground and below where the roots are continuously competing for available nutrients and moisture. The cut material from this red pine plantation was sold, pressure treated with creosote and converted into barn poles and other products. It should be pointed out that scarcity of markets for this small material is one of our major problems in the State. This, however, should not deter the landowner from thinning his wood lot. Even when the trees are cut down or poisoned and left in the woods to die, the increase in volume and value of the remaining trees will more than make up for it in the long run.

The next step in Mr. Hale's plantation management program will be to prune a portion of his remaining trees. Usually the Forester will select about 100 trees to the acre, these to be pruned to a height of 16 feet if possible. All pruning is to be done with a saw, as axe pruning is not recommended and may even be harmful to the tree (see illustration no. 4). The idea behind pruning is the early removal of the lower branches so that at time of harvest the butt log will yield a high percentage of clear (knot-free) lumber (see illustration no. 3). Trees 8 inches in diameter *or under* only should be considered for pruning. Above this size the value received would in most cases not pay for itself.

An additional thinning will be necessary in approximately twenty years, but at that time the plantation should yield small sawlogs, which in Mr. Hale's particular area, should have a ready market.

Now that the Hale plantations are in order, it has been recommended by the Forester that he concentrate his time and effort on the natural woodlands. These, as mentioned at the beginning of the article, are in need of an improvement cut. The woods are full of large-limbed, poorly-formed trees of little or no commercial value which rob the more desirable species of sunlight, growing space, moisture and nutrients. They should be killed either by poisoning or by cutting down. Where such trees to be killed are very large and are overtopping a large number of younger stems of good quality, poisoning would seem to be more advantageous. The felling of some of these very large trees can cause a great deal of damage, particularly if done by an inexperienced logger. The large-limbed, poorly-formed trees, commonly called "wolf trees," are basically the problem (see illustration no. 1). Once steps have been taken to get rid of these and other weed trees, we will have gone a long way toward placing our natural woodlands in good condition.

The future of the Hale woodlands seems assured because the land will be left to his grandson. This is good. The land should remain in the family, for, through Mr. Hale's foresight, the woodlands are increasing in value each year, becoming an ever greater asset. Moreover, the services of a technically trained Forester will continue to be available to the Hale family through cooperation under New York's Forest Practice Act.

ROADSIDE BRUSH CONTROL

Experience gained with 2,4,5-T in Eastern National Forests will guide property owners, town governments, and utility companies concerned with maintaining rights-of-way

W. E. McQuilkin and L. R. Strickenberg

Condensed from *Station Paper* No. 148, 1961*

SEVEN national forests in the Eastern States maintain about 1,700 miles of road, and all now have their roadside brush under chemical control. Without control of some sort, trees and brush encroach on roads. The big problem is trees, especially hardwoods. If allowed to grow for a few years, the young trunks attain such size that they may lean over the roadway, obstructing the view, and often interfere with ditch drainage. Many woody stems become too thick at the base in a few years for clipping with a mower—hence the practice of annual mowing.

Since most of the eastern hardwood species sprout vigorously after cutting, the density of hardwood growth tends to increase under a mowing regime: several sprouts often develop where but one grew before. In addition, the sprouts from established plants are continually being reinforced to varying degrees by new seedlings. These are clipped by the mower, resprout, are clipped again, and in a few years become multistemmed clumps. Thus mowing fails to improve the brush situation, except temporarily; in the long run it tends to intensify the problem.

On utility rights-of-way and in various other situations, chemical herbicides have

*Published by Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Upper Darby, Pa.

A power sprayer, converted from a standard-model fire-control pumper, is fitted with poles to hold surplus hose off the ground when men are spraying close to truck, as shown here. Full length of hose is easily available when needed

In this back-pack type of sprayer, the manufacturer's hose, wand, and valve assembly has been replaced with higher quality equipment.

come into increasing use for brush control. The important question is, can the brush-control job on roadsides and elsewhere, where needed, be done more easily and at lower cost with chemicals than by mowing? The answer is yes.

All critical testing reported here was restricted to the herbicide 2,4,5-T, and to two types of treatment with it: water-foliage sprays at 4 pounds ahg (acid equivalent per hundred gallons of water) and oil-basal sprays at 12 pounds ahg of diesel oil.

Roadside work with these two treatments was started in the George Washington and Jefferson National Forests in Virginia, the Cumberland in Kentucky, and the Monongahela in West Virginia. The Monongahela tests included July, November, and March applications. Treatment units in all these tests comprised several miles of roadside—enough to provide some preliminary indications of time and cost requirements. Individual treatment units varied from 2¾ to 25 miles. All together, some 78 miles of roadside (equivalent to 39 miles of road) were treated in the testing program. In addition, sectors of telephone line rights-of-way totalling some 13 miles, were treated. A guiding principle in all the roadside and telephone line work was to spray selectively insofar as possible. For both aesthetics and soil stabilization it is desirable to retain the herbaceous and low shrubby vegetation. Moreover, a full cover of such low vegetation inhibits the establishment of tree seedlings and reduces the future maintenance job.

Since all of the spraying was done with manually operated nozzles by men on foot, the spray could easily be directed onto undesirable plants and, for the most part, kept off the associated vegetation. Basal stem treatments can be restricted to specific plants somewhat better than foliage applications, but a good deal of selection can be done even in foliage spraying. Many patches and short stretches occupied only by herbaceous plants, or by shrubby species such as low bush blueberry and bunchberry, can be skipped entirely; scattered clumps of taller-growing brush can be spot-treated; only occasionally is overall treatment unavoidable—where undesirable species form practically a solid cover.

Thoroughness of application was emphasized in all the test work. In oil-basal spraying, the men were trained and supervised to soak every stem all around to the point of copious rundown. Experiments by Bramble and others in 1952 had clearly demonstrated the necessity to wet the root-collar area of every stem if resprouting is to be suppressed.

For non-suckering species, all reported kills were apparent root kills (stem base dead, no resprouting); for suckering species such as sassafras and black locust, kills were recorded if stems were dead with no new suckers within a radius of about 2 feet.

Water-foliage sprays generally failed to give satisfactory kills. Certain species, notably the birches, yellow-poplar, sassafras, and sumac, were knocked down

When the back-pack sprayer is in use, the side lever, which is pumped to maintain a constant flow of spray, is grasped by the operator's right hand

fairly well by foliage sprays; but oaks, maples, ash, hickories, beech, and most conifers were more or less resistant.

Oil-basal sprays resulted in high percentages of root kill (80 per cent or better) on almost all non-suckering species except for white ash, which is widely recognized as resistant to 2,4,5-T. Kills of ash were generally 50 per cent or less. Root-suckering species were readily stem-killed but commonly exhibited some recovery in the form of new sucker sprouts originating a few inches to several feet from the original stems. Black locust is one of the most common species in this category; it definitely is the most troublesome because it grows considerably faster than most others. The relatively poor results with sassafras reflect its revived growth by root suckers. Shortleaf pine, encountered only in the Cumberland Forest, exhibited a notable capacity to survive by generating new shoots along the lower stem, even after the foliage became completely brown.

Insofar as can be judged from the test in the Monongahela Forest, season of treatment has little effect upon amount of kill. This is of considerable significance in that it imposes no seasonal restrictions upon spraying.

Coniferous species—mostly white pine, balsam fir, and red spruce—were well represented in the White Mountain Forest, growing in an area along a telephone line. Sizes ranged up to saplings 8 feet or more tall. Seedlings up to about 3 feet tall usually were given a drenching overall foliage and stem spray, and were killed. Larger trees were basal-sprayed in the same manner as the hardwoods. As is now generally recognized by brush-control workers, most conifers beyond small seedling sizes are relatively resistant to 2,4,5-T in both foliage and basal applications. This was confirmed in the White Mountain test: the kill, exclusive of the drenched seedlings, was estimated to be about 25 per cent.

Advantages of the Chemical Method

What, precisely, are the advantages of herbicidal control over mowing?

The average cost for mowing prior to 1956 was about $16 per year per mile of road. The average initial cost per mile of road for selective oil-basal spraying is about $45. But one properly done chemical treatment is good for at least 5 years; thus the cost per year is $9, whereas the $16 mowing job must be done every year. On this basis, chemicals can reduce brush control costs by more than 40 per cent. Actually, some of the earlier spray jobs are holding so well that our estimated 5-year treatment interval appears to be very conservative. Except where black locust is abundant, we believe many roads will hold as long as 8 years or more without retreatment—with proportionately greater savings in maintenance costs. Moreover, the capital cost of spray equipment is considerably less than for mowing equipment, maintenance costs for spray equipment are lower, and less time is lost from breakdowns.

A road in the George Washington National Forest as it looked two years after spraying. With selective oil-basal spraying, encroaching trees and brush have been controlled, allowing herbaceous plants to hold the bank as the ground cover

Driving a power mower is a trying job, as the operator must be ever vigilant in maneuvering his machine along sloping road shoulders, avoiding rocks, ditches, and other hazards. In addition to the machine mowing, it is necessary to do considerable hand cutting with scythes and brush-hooks, and occasionally with axes and saws.

Spraying is easier and a much more relaxed type of labor. If a large spray unit is used, the truck driver moves slowly down the middle of the road, and the physical demands upon the nozzle-men are light compared to scythe or brush-hook work. Spraying with the backpack outfits is more laborious, but in roadside work this ordinarily is required only intermittently, and thus does not become burdensome.

Spraying Permits Greater Flexibility On the Job

Mowing usually has been limited to one swath of 5 or 6 feet; to cut back farther requires a second pass and practically a doubling of the costs for the mileage so treated. Spraying, on the other hand, can be varied to fit the situation from spot to spot; 3 or 4 feet may be adequate here; 8 or 10 feet of clearance may be desirable there.

Spraying Permits Greater Flexibility in Work Programming

Mowing is limited to a period of 2 months or so in mid- and late-summer. But oil-basal or stump spraying can be done at almost any time when the ground is free of snow. And if a spray job scheduled for one year has to be postponed until the next year, no significant complication will ensue.

One of the crucial tests of a new method for doing any job is its acceptance by the people who actually apply or use it. Most national forest personnel with whom we have discussed the subject, from supervisors down, are sold on chemical control of brush growth.

Summary

Our basic policy, adopted during the the testing period and unchanged today, is to rely mainly on the selective basal method. By so doing we: (1) minimize objectionable mass killing of the foliage, commonly referred to as "brown-off;" (2) save most of the desirable low vegetation; and (3) accomplish maximum root kills; thereby stretching the interval between treatment to 5 or more years. So, although selective oil-basal treatments cost more per application than roadside mowing, the average per-year cost is lower.

DWARFING PLANTS WITH CHEMICALS

Research discoveries that modify plant growth

Condensed from ARS Special Report No. 22-65, January, 1961*

CHEMICALS as braking tools, to hold back stem growth of a plant and halt it at a desired height, are among the newest plant regulators that research is developing and trying out to serve practical needs.

This research is in line with a strong modern trend—toward increasing demands for compact plants by crop growers, home gardeners, and the flower-buying public.

The first satisfactory dwarfing of a plant with chemicals was achieved by Agricultural Research Service scientists in 1948 with nicotinium compounds applied to the Black Valentine snap bean.

Then in 1950, ARS scientists reported that six quaternary ammonium compounds were far more potent for successful dwarfing than the nicotiniums previously tried—hence the new compound named Amo-1618.

Plant species, and even varieties, have been remarkably selective in the retardant chemicals to which they respond. Many plants have reacted to a few compounds or only one. When Amo-1618 was tried on 50 crop plants, it reduced stem height markedly in only the following: bush lima and snap beans, calliopsis, chrysanthemum, lettuce, sesame, and sunflower. A slightly different compound, named carvadan, has induced stem-shortening in some plants that would not respond to Amo-1618.

Since 1957, ARS plant specialists have done considerable research on chemical dwarfing of chrysanthemums, lilies and some other plants. Successful treatments show varied practical merits.

In tryouts of more than 100 compounds on chrysanthemum plants, Amo-1618 was outstanding. This chemical caused the mums to grow very short stems and bear full-sized blossoms. The dwarfed plants were pronounced ideal for small, well-shaped potted flowers. A newer chemical, called phosfon, is also effective on chrysanthemums.

Applying Amo-1618 to the soil is the easiest method of using it. Water solutions have been effective either when mixed with the pot soil or poured on the soil as a drench. Chrysanthemum plants treated with this chemical respond to long and short days just like untreated plants.

Although poinsettias responded scarcely at all to Amo-1618, carvadan, an isomer of Amo-1618, can successfully dwarf a tall-growing poinsettia variety down to half or a fourth of its normal height. In chemically dwarfed poinsettias, all parts of the plant are scaled down to size. The "flowers"—actually bracts—are slightly smaller, also fewer, than on the same variety untreated. In a "pint-size" poinsettia pot plant, this overall dwarfing maintains good proportions. Treatment does not delay the flowering of poinsettias. Lower leaves stay on the plant throughout flowering.

Experiments indicate that lilies can be chemically dwarfed to adapt them to more varied decorative uses. Easter lilies of the cutflower type, even those growing 4-foot stems suited only to church decoration, can be made over into superior pot lilies, short and compact. Garden lilies that grow overtall can be held down in

*Published by the Agricultural Research Service, U. S. Department of Agriculture, Washington, D. C.

height too. Some garden varieties, when shortened, would be suitable as new types of pot lilies for indoor flowers.

The life story of the compact plant has now been tested; it is no freak. Dwarfed by a proper chemical treatment, the pint-size plant is essentially normal and is influenced by environment like any full-sized plant.

As this report goes to press, at least one chemical for dwarfing an ornamental has reached interstate commercial sale under trademark. The compound called phosfon has been officially registered for height-retardant use on chrysanthemums grown in commercial greenhouses. Manufacturers are working toward marketing other promising chemicals, such as Amo-1618 and CCC. No chemical for this type of overall height control has been federally registered thus far for use on a food or feed crop.

A NO-MAINTENANCE VEGETABLE GARDEN

Mrs. Robert A. Hack

Reprinted from the *Bulletin of the Garden Club of America*, July, 1961

WE have found a way to maintain a good-sized vegetable garden with sub-minimum care. Our secret is simply the use of building paper. Early in spring, before any weeds have popped through the bare earth, we buy a roll of #15 asphalt felt paper at the lumberyard. The roll is 36 inches wide and contains 144 linear feet. The cost is under four dollars. (Half rolls are available.) Rolling out the paper, we cover every inch of our rectangular garden. The 36-inch strips are held down with planks or a few rocks. Planks later have the advantage of serving as paths between the rows of vegetables.

When the time comes to plant young tomato plants, cut-flower seedlings, or whatever we wish, we merely cut circular holes in the paper with a sharp kitchen knife, allowing the proper distance apart for the mature plants-to-be. Next, in go the plants, with some fertilizer added in each hole. When planting seeds such as lettuce we cut a long slice a few inches wide, the length of the row and plant the seeds in the exposed area.

All summer the maintenance is almost zero. Occasionally a couple of weeds may sneak through the 8-inch holes around a tomato plant but they are easily pulled out. If additional fertilizer is needed, it can be added with a trowel around each plant. Watering is virtually unnecessary. Uniform moisture and temperature of the earth are maintained beneath the heavy paper covering even in a drought. The paper has an added advantage. If you are growing squash or other vine-borne vegetables, or tomatoes that over-run their stakes, the fruit does not rot or spoil as it lies on the paper waiting to ripen, as it often does on bare soil.

With this system you can go blissfully off on your summer vacation and return to find, not a horrendous jungle, but a delightful status-quo in the garden!

WHAT ARE SEEDS?

Seeds are many things. They are a way by which embryonic life can be suspended and then revived, even years after the parents are dead and gone. Seeds are highly organized fortresses, well stocked with special food supplies to sustain and protect life against a long siege.

Seeds are vehicles for spreading new life from place to place with the aid of animals and people. Seeds are food for man, animals, and other living things. Seeds are raw material for fashioning into a myriad of products. They are wealth, beauty, a symbol of beginnings, carriers of aid, friendship and good will.

Seeds are a source of wonder—the objects of man's ceaseless search for understanding of living things. But above everything else, they are embryos of a new generation, nature's way of insuring continuing life and the survival of their species.—Abstracted from "Seeds," The Yearbook of Agriculture, 1961. Published by The U. S. Department of Agriculture, Washington, D. C.

HOW TEN PLANTS OF THE AMERICAS TRANSFORMED WORLD AGRICULTURE

Reprinted from *Foreign Agriculture*, February, 1961*

SINCE 1492, the New World has endowed the Old World with treasures of far more value than those Columbus was seeking. Some of the earth's most important plants were discovered in the Americas.

Of these plants, six—corn, peanuts, manioc, sweetpotatoes, beans, and potatoes—are now basic foods in countries around the world. Two—cotton and rubber—are major raw materials and bulwarks of foreign trade. Two—cacao and tobacco—are not only major cash crops but contribute to man's pleasures.

Corn. Throughout the prehistoric Americas, corn (maize) was already a staple food. Columbus took samples to Spain; two generations later, the crop had spread to most of Europe, to Africa, and even to Tibet.

One reason for this rapid spread was that the Indians had developed many strains of corn to suit their varying local conditions. Today, the Americas still produce much of the world's corn, owing to the vast U. S. crop; but corn now grows on every continent. The bulk of the harvest is usually consumed on the farm, by the farmer or his stock. Yet so huge is the world crop that the tiny percentage that is exported makes corn one of the three most important grains in world trade.

Peanuts. The peanut probably originated in Brazil or Paraguay; it has been found in prehistoric Peruvian graves. But it reached the United States fairly recently, from Africa. Early Portuguese traders had taken it there as ship rations, and Negro slaves brought it back to this hemisphere.

Peanuts and peanut oil are now top exports for a number of countries, foremost among them Nigeria, Senegal, India, and Mainland China. In the United States, people eat peanuts mostly in candy and as snacks. But in many countries, especially in parts of Asia and Africa, protein-rich peanuts and their oil are basic foods.

Manioc. The many-named manioc also called yuca and mandioca in Latin America and cassava in Asia and Africa, probably originated in Brazil, where it has been raised since prehistoric days. Europe first heard of manioc through Columbus, but elsewhere it spread mainly through the Portuguese, who took it as ship provender to India and Africa. It is now a dietary mainstay for millions in the tropics of Africa, Asia, and Oceania, as well as South America.

Sweetpotatoes. Origin of the word "potato" was "batata"—the West Indian name for the sweetpotato. After Columbus met this tuber, it soon won popularity in Spain and Portugal and later followed explorers to most of the world's tropical areas.

One of the richest food plants, the sweetpotato usefully supplements the big staple crops of Asia and Africa—rice, corn, cassava—for it is higher in vitamins and minerals. This fact gives it an economic importance that cannot be measured by acreage, production, or money value.

*Published by the Foreign Agricultural Service, U. S. Department of Agriculture, Washington 25, D. C.

Common beans. There is little doubt that the common bean originated in the New World, for after 1492 the varieties of beans recorded in Europe suddenly increased. The American species include the garden beans (snap, string, wax), field beans (navy, pinto, kidney), and limas.

In many meat-scarce countries, dried field beans are a major food, furnishing most of the protein eaten. The Americas are still the main producing area, but the common bean is now widely grown in Europe and Africa also. Much production is from gardens and does not show in agricultural or trade statistics.

Potatoes. Native of Chile, Peru, and Mexico, the white potato went to Europe with Spanish explorers in the early 16th Century. The English got it from Spain and by 1663 were recommending it to the Irish as a famine safeguard. The Irish, in turn, probably established it in England's colonies, for the first potatoes grown there came from stock brought to New Hampshire in 1719 by Irish immigrants. Potatoes now grow the world around, but the biggest crops are in northern and eastern Europe, where they are valued for both food and feed.

Rubber. Major commercial source of rubber is a South American tree, *Hevea brasiliensis*. In 600 A.D., Indians were already using its milky sap to make waterproof clothes, battle shields, and balls. Spanish explorers first saw it in the early 1500's, but it remained largely a curiosity until Europeans began intensively tapping the wild trees about 1750.

Unlike most other New World plants, the rubber tree was deliberately introduced overseas. In 1876, plants grown in an English hothouse from Amazonian seed were shipped to Malaya and Ceylon to start the world's first rubber plantations. A "rubber belt" now stretches around the earth 10 degrees north and south of the equator, though Southeast Asia is still the chief area. For producing countries, rubber is a top export, for importing countries, it is a vital raw material.

Cotton. When Columbus found cotton growing in the Bahamas, he thought he had reached India, then the cotton center of the Old World. This cotton, however, belonged to a New World species—one of two destined to be adopted in so many other areas as to overshadow the old Asiatic forms completely. One, from the hills of Central America and Mexico, gave rise to the Upland types. The other, from South America, is the source of famous cottons like the West Indies' Sea Island, Peru's Tanguis, and even those of Egypt. Between them, the New World species account for about 90 per cent of the world's output and an even higher share of its trade.

Cacao. The scientific name of cacao —*Theobroma* (food of the gods)— came both from the plant's importance in Aztec religion and from the delectable taste of chocolate. Native to Central and South America, cacao moved to an African island, Fernando Po, with the Spaniards. Not until some 75 years ago, however, was it introduced to the mainland, Africa, where Ghana is the world's largest single cocoa bean producer, has now far outstripped the Americas, with more than 60 per cent of world output, but production is rising nearly everywhere in the tropics.

Tobacco. When one of Columbus's crew became the first European to try a cigar, the Indians of the Americas had already been using tobacco in all its forms for over a thousand years. In the north grew harsh *Nicotiana rustica* (the peace-pipe tobacco); in the subtropics, mild *N. tabacum*. Spanish and Portuguese sailors took to the "bewitching vegetable" at once; its culture soon followed their ships around the globe. Today, *N. rustica* is grown in Asia, the Middle East, and East Europe, but mostly for home use. The tobaccos of world trade—even the so-called Oriental types—are nearly all of the *N. tabacum* variety and owe their origin to the Western Hemisphere.

ENDANGERED RELIC TREES

The West's rare trees are becoming rarer

Paul D. Kilburn

Condensed from *Natural History*, December, 1961

IT is scarcely surprising that California, the state with the greatest ecological variation in the United States—where habitats stretch from below sea level to over 14,000 feet, and climates vary from desert heat to alpine cold—should possess a world-famous aggregation of tree species. Many of these trees are confined within the state's boundaries and, in fact, more than 1,400 of the total vascular plant flora (some 4,000 species) are restricted to the state. Others spill over, but only slightly, into the geographically similar parts of neighboring states and Mexico. Many of these endemic plants are extremely rare, found only on a particular island, desert, or mountain.

These relics, remnants of former widespread forests, emphasize that extinction is always a possibility and that a slight change in the environment could easily eliminate them. Such has often been the case in the past, for extinction has been a corollary to evolution. While the number of known plant species is enormous (upwards of half a million), many more than this number became extinct as natural selection weeded out those species that could not adapt to a changing environment. But such extinctions took place slowly; organisms had but to adapt gradually to a changing environment in order to remain alive.

Today a new environmental force, acting with extreme rapidity, faces all biota —namely, man and his actions. This force has the ability both to eliminate and to propagate. With wisdom and foresight, man can be the means of insuring survival of the isolated stands of trees discussed in this article; with carelessness, as has been the case all too often in the past, he can be the means of their total and irreparable destruction.

The star of California's relic trees is that twisted coastline rarity, the Monterey cypress (*Cupressus macrocarpa*). Fame has come to this species for its location on the seacoast of the Monterey Peninsula, about 100 miles south of San Francisco. The number of wild individuals of this tree is in the thousands, all growing within a few miles of each other on the rocky southern coast of the peninsula and Point Lobos, a few miles to the south. Here, they present a fitting adaptation to the strong, constant sea wind, molding themselves to the rugged rocks. This cypress is a short tree; the tallest is 60 feet, and its widespreading shape is much more typical of an oak than it is of a conifer. Dense foliage is produced by a thick growth of branches extending to the ground, where the trunk may be 3 feet thick. Although a poor timber tree, it makes an ideal windbreak near the ocean. Unfortunately, it apparently requires the sea fog to flourish, and its distribution is limited.

Two species of the formerly widespread genus *Sequoia* survive today in California. The coast redwood (*S. sempervirens*), the world's tallest tree, occurs beyond California for some eight miles into southern Oregon. This species, an abundant tree along California's northern coast, is still logged commercially. Valuable and enormous, it is a relic of the former widespread sequoia forest that once grew as far as Greenland and Alaska in past geological times.

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Monterey cypress bent to grotesque form by constant winds off the sea. This species does not exist inland away from the fog-bound coast

Many redwoods tower 300 feet or more, but the tallest of this race of giants is found in the heart of the redwood belt, far north of San Francisco, at Dyerville Flat. Here the Founders Tree towers 364 feet above the ground, yet so tall are its neighbors and so accustomed to loftiness is the visitor, that this unbelievable height does not seem extraordinary from below. The diameter of the largest trees often exceeds 10 feet. Sometimes they attain 15 feet and, rarely, 20 feet, with a maximum of 22.5 feet; yet these girths rank well below those of the Sierra big trees.

Ecologically, the redwoods are confined to areas that receive the summer fog belts that roll in from the Pacific early in the afternoon, shrouding the tall giants in a cool, moist blanket until the late morning sun burns the cover away. Because of this dependency on ocean fog, the tree is never found more than 40 miles from the Pacific, and usually it is much closer. Thus, a narrow belt of redwoods extends from the Oregon border for some 450 miles down the northern coast of California, breaking down into scattered and separated ravine-bottom groves south of Big Sur, near the extreme southern range.

The work of preserving virgin stands of redwoods from logging for all time was undertaken jointly by the Save-the-Redwoods League and the state of California. As the result of this unified, cooperative venture, 65,000 acres of redwood land have been preserved. Much of this land is in small groves and parks near major highways, available for the enjoyment of travelers for many years to come.

A close relative, the Sierra redwood (*S. gigantea*) or big tree, the largest living thing, is a true relic of the western slope

of the Sierra Nevada mountain range at elevations from 4,000 to 8,000 feet. The tree occurs in scattered groves over a north-south span of 250 miles. While not facing immediate extinction, it is a relic of wider distribution in the past. The big tree is probably the world's most impressive and famous tree. Although not one of the tallest trees, its unbelievable girth makes the observer's first impression one of disbelief.

Since the discovery of these groves in 1852, man has had a decided effect on the future of the trees. Of prime importance was placement of most of the groves in public ownership, where they can be protected and easily visited by everyone. This ownership pattern ended destructive logging on public land, an activity that aroused public opinion. Unfortunately, logging still persists on private lands.

We do not know the effect of the virtual elimination of fires—which have always been part of the natural environment of these trees—on their future. Nearly all the larger trees attest to former fires with charred bark and deep scars. Cessation of these fires has allowed a dense forest of white firs to spring up in many places, preventing young Sierra redwoods from becoming established. More research on the effect of purposely set, light fires to encourage sequoia reproduction is needed.

Finally, man's trampling of the soil around trees and in the better-known groves may adversely affect the health of these giants. The Park Service, taking cognizance of the problem, has enclosed the most popular trees with fencing. This protection is needed for many others, however, as trampling has compacted the soil a foot or more around some trees. In the future, healthy stands will require close and intelligent management.

Several unusual pines occur among those growing wild in California. Ranging in size from the short, squatty pinyon pine of the desert border to the tall, majestic sugar pines of the Sierra Nevada, this group is perhaps the most conspicuous of California's tree cover. Like conifers throughout the Northern Hemisphere, the pines grow in nature's ecological slums. Sturdy and abundant, they are found at desert fringes, on bare rocks, and at the highest timber lines.

Two of these pines evoke unusual interest—one bordering the Pacific shores, the other growing at high timber line. It is the former, a tree clinging to the bluffs

Sierra redwoods are the tallest of all living things. This is the General Grant Tree, 271 feet tall and over 20 feet in diameter for its first 100 feet. King's Canyon National Park, California

Torrey pine may be the world's rarest tree. It grows wild north of San Diego, California, and on Santa Rosa Island. Today, only 3,000 individual trees are known to exist

Photos by
Josef Muench

of the Pacific at Del Mar, just north of San Diego (it grows wild in only one other place— Santa Rosa Island, just off Santa Barbara) that lays claim to the title of the world's rarest tree. Here the Torrey pine (*Pinus torreyana*), represented by only about 3,000 small, twisted individuals, faces the steady and forceful sea breeze from the Pacific. This number appears large in comparison with figures on certain rare animals, yet in fact it is extremely small when the future of the species is at stake. A plant has no means of moving out of the way of fire or severe storms that could eliminate its wild populations. This tree is certainly on the verge of extinction.

Many of the pines near Del Mar are protected within Torrey Pines State Park, and what a wild, magnificent collection of beach and coastal bluff flora is found there! The pines persist in gullies and ravines leading oceanward and dominate the vegetation, although few exceed 30 feet in height. Surprisingly, when planted in protected places the Torrey pine is majestic, straight, and fast growing. Thus we see that the growth form of this pine is obviously influenced directly by the environment.

But it is a relatively abundant pine, one found in several western states, that in California reaches its greatest age and becomes the "oldest living thing" in the world —the bristlecone pine (*Pinus aristata*) growing at timber line in the White Mountains near the Nevada border. Here, in the rain shadow of the Sierra Nevada, at 9,000 to 11,000 feet, occurs one of the strangest forests in the world. Its age and

ppearance makes discussion of the pine ppropriate, even though it is not rare. 'he eerie woodland it dominates consists f very open stands of the massive, short ree atop the dry, rounded mountain- ops. The needles of the bristlecone, al- hough in clusters of five, are a mere 1 r 2 inches long, and are indicative of a ong-continued adaptation to its high, dry abitat. The cones bristle, as the name uggests, and cluster easily within reach n all but the largest trees. Tree size is leceptive here, for the growing season is hort and a tree 10 feet tall may be 75 ears old. The oldest veterans may be but 0 feet tall, with diameters 2 feet at breast eight.

Age is evident in every branch of these rees; looking at them, one can almost eel the brunt of the severe winter storms he bigger trees have withstood. Many re dead except for a narrow strip of ark and living tissue leading from the roots to one remaining branch. The most impressive sight in the entire area is the aptly named Methuselah Lane, a steep slope on which many of the trees are more than 4,000 years old, and where the oldest one yet sampled, more than 4,600 years of age, still grows. Trees on this slope are often more dead than alive, yet stand silent guard over many fallen but undecayed individuals. Such falls represent centuries of accumulation, for decay proceeds very slowly on the rocky surface.

A perplexing feature in the forests is the presence of charcoal and fire scars on most of the old tree trunks. The open character of the trees and sparseness of the undergrowth make one wonder how such fires could spread, and what possible influence this has had on the distribution of the forests. Do the scars mean simply that the undergrowth was once shrubby, but has been killed by repeated burnings until only tiny annuals and rosette plants

Coast redwood (*Sequoia sempervirens*), abundant along the northern coast of California, is also found a few miles into southern Oregon. Those below are along the Eel River on the Redwood Highway, California

Desert Fan Palm shows thatch effect of dead fronds on the trunks. The greatest threat to this tree's continued existence is the extreme flammability of its thatch

now exist? Does it mean that the absence of seedlings in some areas is the result of repeated fires? Answers to these questions must await more precise studies, including those at the Laboratory of Tree-Ring Research of the University of Arizona.

The area including most of the California populations of bristlecones lies within the Inyo National Forest and is, of course, protected by the federal government. Already, improvements in the roads and campsites are under way and the area will certainly be visited much more frequently in the future. And visited it should be, for the view from these mountains across the Owens Valley to the rugged Sierra Nevada must rank as an outstanding scene in the state.

One more tree remains to be discussed—the picturesque desert fan palm (*Washingtonia filifera*). This, California's only native palm, is not confined to the state, for a few are found in western Arizona and several in Baja California, but its unusual appearance and habitat, and its scattered distribution deserve mention. It occurs in Southern California on the fringes of the low, hot Colorado Desert, which surrounds the Salton Sea. Here, usually in canyons and along streams issuing from the mountain ranges, the palm appears to be making its last stand against an increasingly hostile climate. In California, these tall, stately trees normally wear a thatched skirt of dead leaves that reaches nearly to the ground, and groves of these palms present a memorable sight. Groves vary in size from a few to many individuals depending on the number and size of mountainside streams or springs.

One of the most extensive views of these trees and their habitat can be seen by looking east from the Palm-to-Pines highway, State Highway 74, some 3,000 feet up in the San Jacinto Mountains, overlooking the Coachella Valley. Far off in the distance rise the Little San Bernardino Mountains and below them are the Indio Hills. The palms appear as widely separated patches of green, dotting the base of these hills for miles. Closer approach reveals that they occur along the notorious San Andreas fault in places where streams and gullies dissect the hills. Here, exposed to the full blast of the desert sun on the south-facing slope, the palms grow in one of the world's most rigorous climates.

One can approach many of the groves readily, but the close-up view is often disappointing, for most of the trees have had their thatch burned off by man-made fires, and only charred trunks can be seen. Fire is a major enemy, since the thatch is high-

flammable and burns with such heat at the terminal, leaf-producing area is ten killed and the tree dies. Those that rvive remind one of shorn sheep, differ- g from those animals in that they never gain their cover.

Most of the trees are unprotected on ivate lands, although the largest grove Palm Canyon, just south of Palm prings, is owned and managed by the nta Inez Indians. A few small groves e under National Park Service jurisdic- on in the Joshua Tree National Monu- ent. The trees do reproduce, however, d the occurrence of some seedling palms ill insure the species' continuance for me time under natural conditions.

Both the age of the oldest and their un- own history provide the palms with an ra of mystery. No one has yet deter- ined how old the trees are, for these onocots lack a cambium and hence have annual rings. Another area of interest s in their discontinuous distribution, for e scattered groves suggest that they once d a connected distribution pattern under more beneficent climate. Verifications of is feature and of the trees' ages await rther investigation.

Probably no other area of comparable size anywhere in the world possesses so many rare and interesting trees as the state of California. Here are found the world's tallest, bulkiest, oldest, and probably rarest trees. All are in magnificent natural settings and, fortunately, some of each grow on publicly owned and managed land. But all are accessible to the automobile. With today's growing population and vastly increased mobility, such biological phenomena will receive increasing numbers of visitors. Seen they must and should be, for their value to man is immeasurable.

Looking to the future, before man can create environmental changes, three lines of activity are urged. First, much more of our flora and fauna—not alone these unusual trees—must be preserved in parks and wilderness areas for future enjoyment and study. Second, active research into the historical development and ecological relations of many of these plants is needed before changes brought about by fire protection and increased human use make such studies difficult. Third, aided by the knowledge gleaned from such research, active management—not a "locked gate" policy—may be needed to insure their future.

RITISH GARDENERS ARE TESTING IRRADIATED SEEDS

HERE are 394 horticultural organi- zations listed in "The Directory of merican Horticulture for 1958." To this ngthy list still another may soon be lded—the Atomic Gardening Society.

H. Gleason Mattoon, writing in the *oston Herald,* reports that the British ganized such a society over two years go. Members grow plants from seeds at have been blasted with cobalt 60, for ossible worthwhile variations.

All seeds sent to Great Britain are eated at Oak Ridge Atomic Industries, ak Ridge, Tenn., under the supervision Dr. C. J. Speas.

Careful records are kept of the number of seeds planted, the date, germination period, unusual growth, and any other factor that seems important. Plants that vary in some worthwhile manner from normal are permitted to go to seed, and these seeds are carefully preserved for pest-growing the next year. In this way, there can be some assurance of fixing the variation caused by atomic blasting.

Dr. Speas is now organizing an atomic gardening society in this country with headquarters at P.O. Box 229, Oak Ridge, Tenn. Considerable quantities of seeds have been treated at Oak Ridge Atomic Industries, which are available from one or more seed distributing companies.

A POPULATION EXPLOSION IN THE WORLD OF PARASITES

Key facts that everyone should know

Jerry T. Walker

NEMATODES, the most widespread pests of plants in the world today, have brought untold destruction to agricultural and ornamental crops. Mostly microscopic in size, they have wiped out citrus groves, spread through millions of acres of cotton, threatened the bulb growing industry in the Pacific Northwest, and invaded tobacco fields, vineyards, truck farms and nurseries across the nation. Even now, the full extent of the nematode's activity is not known. Yet, nematodes were largely ignored as relatively harmless parasites until the late 1940's.

Evidence of nematode invasion in the garden can be detected in a number of ways. Where this pest is present, carrots develop thick clusters of whiskery roots, peonies have warty roots and become sickly and do not bloom, daffodil foliage gets stunted and soon the bulbs rot away, and the lower leaves of garden chrysanthemums turn brown and drop off. The nematode is such a universal pest of African violets that commercial growers make a regular practice of sterilizing the soil into which freshly rooted leaves are potted.

In order to understand fully the seriousness of the situation, it is helpful to know how this pest lives and propagates, and also the problems involved in its control.

Nematodes occur in a wide variety of habitats, and in all extremes of climate. Many exist in the soil at one time or another during their life cycle, but many live in the sea. Some are beneficial, feeding on microorganisms and decaying matter, others are parasites of plants and animals, including man. Some are capable of withstanding extended dry periods, but all require a film of moisture to remain active. They move only short distances under their own power yet are transported over wide distances by man, animals, or the natural forces of wind and water.

Nematodes are slender, simple looking worms tapering at each end, and commonly called eelworms. Those that parasitize plants may be as small as a fiftieth of an inch long, whereas those that are parasites of vertebrate animals range in length from less than a twenty-fifth of an inch to more than 40 inches and are often called threadworms or roundworms. Separate sexes are usual but the male may not be necessary for reproduction that is accomplished by the egg-laying female.

The "nema" parasites of man include *Trichinella spiralis,* the cause of trichinosis (from infested pork) and *Strongyloides stercoralis,* which causes intestinal diarrhea. Another nematode, *Necator americanus,* is one of several important hookworms of man which occur in parts of southern United States and South America. *Ascaris lumbricoides,* which apparently was recorded in Egyptian writings as early as 1500 B.C., still commonly occurs in tropical countries where sanitary measures are lax. When the Ascaris nematode is taken in as a food contaminant it invades the small intestine then migrates through the blood to the lungs, bronchi and other organs.

Although plant-feeding nematodes have been known for some time, it is only since World War II that they have received appropriate attention. As crop destroyers in agriculture their economic importance has led to the discovery and use of chemical control measures. The success of chemicals for nematode control was realized about 1944 in the Hawaiian pineapple fields. This stimulated widespread search for new and better nematocides, and created greater interest in plant parasitic nematodes.

Most plant parasitic nematodes feed on roots or other below ground parts of plants. Some actually penetrate roots (*endoparisites*), while others feed only from the outside (*ectoparisites*). But wherever they feed they all possess a hollow spear called a stylet. This movable stylet pierces the living cells and the nematode sucks out the cell contents and at the same time injects enzymes or "enzyme-like" materials which have decided effects upon the chemical organization of the cells. It seems likely that the widely known root-knot nematode secretes a certain kind of enzyme that releases growth substances that stimulate the overgrowth of the cells.

How do plant roots attract nematodes? Nematodes have structural features called amphids or "chemo-receptors" which we suspect allow them to detect substances that diffuse out of roots into the adjacent soil. Certain root secretions may attract them, while others may be repellants, and still others influence the hatching of eggs. In the absence of host plants like potato, the eggs of a cyst nematode hatch rather slowly, but hatch rapidly in the presence of the growing root. Moreover, the action of the root secretion is sometimes quite specific, *i.e.*, a given species may be stimulated to hatch only in the presence of certain plant roots. There may be numerous answers as to the how and why of nematode attraction and egg hatching, but whatever the answers ultimately are, they will be a great help in the development of nematode-resistant plants and new chemicals that might be useful in control.

Populations of plant nematodes are very dynamic. "Population explosions" are an old story to them. Their numbers vary tremendously from crop to crop, soil to soil, and season to season. In the spring there may be as few as a hundred nematodes per pint of soil, but as the season progresses this quantity of soil may contain five to seven thousand! Certain species are found more abundantly in sandy soils whereas heavier soils favor other kinds. Their activity is greater and distribution wider in warm moist soils, hence greater nematode worries for Florida, California, and the more tropical parts of the world.

The number and kinds of crops in rotation also influence the buildup of certain species. For example, continuous cropping of potatoes increases populations of the nematode *Pratylenchus,* and decreases yield. This simply means that *Pratylenchus* gets along best on a potato diet. Therefore, crop rotation and depriving "nema" pests of the plants on which they feed can be effective measures in reducing damage.

Perhaps of greatest interest to plant disease specialists has been the effect of nematodes on plants when found in conjunction with other disease-producing organisms in the soil. For example, greater fungus growth sometimes occurs within roots at the site of nematode activity. This accentuates disease. Highly important recent research shows that nematodes may be carriers of plant viruses. For example, they are known to be transmitters of viruses that cause such diseases as peach yellow bud, tomato black ring, grape fan leaf, and tobacco rattle.

Can anything be done to control these obnoxious and pestiferous parasites? Control measures whereby chemicals are applied to the soil prior to planting have been increasingly effective. Cost of these materials, as well as the need for specialized application equipment, however, have limited their use to high value crops. The sugar beet and soybean industries are concerned about infestations of cyst nematodes and are supporting the research necessary to find resistant varieties. Also plant quarantines and inspections are helpful barriers against the spread of nematodes.

Heat is also an effective means of killing nematodes in soil or plants. By exposing plants or plant parts to carefully regulated hot water for brief periods certain kinds can be eliminated without permanent damage to the plants. Biological control methods (see the Botanic Garden's Handbook on Biological Control of Plant Pests) have met with varying degrees of success.

These and many other enlightening investigations are being carried out currently by research institutions.

Back from Hawaii, a tourist watches as a plant quarantine inspector seals her luggage with adhesive tape after checking it for plant materials and fruit

HOW TOURISTS UNWITTINGLY ENDANGER OUR AGRICULTURE

Ralph W. Sherman

Reprinted from *Foreign Agriculture*, August, 1961*

A MIAMI school teacher, returning from a vacation spent in South America, entered Customs at the Miami International Airport with a handbag in which were neatly tucked several leafy sprays hung with red berries. When the plant quarantine inspector told her that she could not bring them in, she was somewhat incensed. She had selected these sprays from coffee plants in Brazil and was bringing them back to show her class how coffee grows.

A quick glance at the berries had told the inspector that they contained insect infestation. Later, when the berries were closely examined, they were found to contain 58 larvae of the Mediterranean fruit fly, the destructive citrus pest that twice had made incursions into Florida, necessitating expensive campaigns to eradicate it.

Such incidents are quite common and always have been. But with more people going abroad every year, either as tourists or on business, the problem has become a very serious one. In 1960 well over 4 million persons entered the United States at the nation's international airports and

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another million at its steamship ports.

This travel boom has placed a tremendous burden on our plant quarantine inspectors. During the year ending July 1, 1960, there were over 300,000 interceptions of plant materials and, of these, over 30,000 were either diseased or infested with dangerous insects. This averages a potential threat to U. S. agriculture every 17 minutes.

The temptation to stow away in a suitcase an interesting plant, a few bulbs, or some especially nice fruit and vegetables is usually quite innocent, with no real intent to smuggle in forbidden goods. With air travel across the Atlantic reduced to 6 hours by jet, it seems so easy to bring home a few tulip bulbs from Holland, or an unusual shrub. Furthermore, because of this quick crossing of oceans, fruits and vegetables enjoyed abroad can be brought home to be served fresh on the family dinner table. People even try to bring in meat products—the sausage that tasted so good in Vienna, the appetizing salami from Italy.

Not all tourists are guiltless. There was the case of the middle-aged Oklahoma doctor and his wife who returned from a Mexican motor trip via Laredo, Texas. The car had been almost cleared by a plant quarantine inspector when a small orchid plant was discovered, leading to a thorough search. This netted eight more orchid plants, a mango, and some orchid and tree seeds, all concealed about the car, in luggage, and on the persons of both husband and wife.

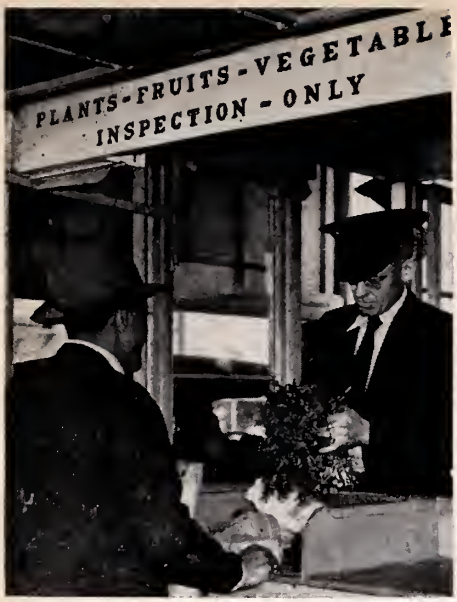
Customs then assessed a fine of $15.00 to cover the undeclared materials. However, the inspector was pleasantly surprised when the doctor congratulated him on his thoroughness. He added that he had expected to be waved through without inspection. Very fortunate it was that the seeds were detected, for a later examination disclosed parasitic wasps.

Many of our well-known plants came from abroad. Before the U. S. Plant Quarantine Service was established in 1912, immigrants often brought cherished plants from their home country, and there were travelers who went abroad on plant-exploration trips to bring home exotic flowers and trees for their gardens.

Many of our azaleas, for instance, came from Japan. Apples are natives of southeastern Europe and southwestern Asia. Callas came from Africa, the eucalyptus from Australia, and weeping willows from China.

It is not the intention of the Plant Quarantine Service to prohibit insect- and disease-free foreign plant materials from entering the United States. In recent years, our bill for imported nursery stock and plant materials has totaled around $14 million a year. These shrubs and plants, however, are brought in commercially, through the proper channels, and in accordance with quarantine regula-

Cars from abroad must be steamwashed but this Detroit inspector is making sure that no soil still clings to the underpinnings



Before produce can be brought across the Mexico-U.S. border, it must be carefully checked at the point of entry

A foreign-grown orange, brought by plane to the Washington, D. C. airport, is examined for possible fruit fly infestation

tions of the U. S. Department of Agriculture.

The tourist usually is not familiar with these regulations, nor is he aware of the fact that, while air travel permits bringing home plants and produce without deterioration, it also aggravates the problem. When intercontinental travel consumed a couple of weeks or more, fruits and vegetables usually rotted and were discarded en route. Plant materials withered and dried up so that the chance of either insects or diseases surviving was slim. Now such items arrive as fresh as though just purchased in a garden shop, and if they harbored any disease or pest at the start of the journey, these still exist to endanger our gardens and orchards.

To prevent the hard feelings caused by the often very necessary confiscation of plants and other agricultural products, the Plant Quarantine Service has embarked upon a campaign to explain to United States-bound travelers their responsibility to our agriculture—and to gain their cooperation.

Educational activities are now under way that are aimed at catching the attention of the traveler before he embarks for the United States. Being forewarned, passengers can avoid stowing away in their luggage the prohibited plants and produce only to have them confiscated upon arrival.

Being given the widest distribution is a small flier, with a brief, pithy narrative printed in English on the face and repeated in French, Spanish, and Italian on the reverse side. Airlines and steamship companies hand this flier to passengers as they check in for international flights and cruises, placing them in ticket folders when convenient. The message can't be missed, for it's headlined "Don't Help Hitchhikers."

In addition, the Passport Office of the U. S. Department of State is distributing to passport applicants copies of a general brochure on the danger of bringing in foreign agricultural pests and diseases; and U. S. agricultural attaché and consular offices around the world are also participating in this drive to safeguard our crops and livestock by supplying quarantine information to travelers and exporters.

THE LAW AND YOUR GARDEN

These basic principles will help you decide whether or not the law is on your side

Bernard Schwartz

Condensed from *The American Home*, September, 1961

IS IT legal to saw off the overhanging limbs of your neighbor's tree? Can a visitor sue you if he hurts himself in your yard? Can you stop the man next door from burning smelly rubbish? Can he stop you from growing plants that give him an allergy? Are the parents responsible if children pick your flowers and damage your plantings? Can you prevent the government from dousing your property with poison spray?

Just what *are* your legal rights and obligations as a property owner and gardener? Actually, you can't always be sure. In situations where a local, state, or federal statute is applicable, the question of rights or obligations may not be too difficult. But most property relationships are governed by common law (unwritten law established by custom and by court decisions), and in such situations it's sometimes difficult to decide just where you stand. It's much easier, however, if you have some understanding of the legal principles involved.

Society vs. the Individual

Take the 1958 case of Robert Cushman Murphy of Long Island, New York, who tried to stop the federal and state aerial spraying program for eradicating the gypsy moth. He claimed the low-flying planes were trespassing and illegally placing a noxious substance on his property. But the federal court held that the government had the legal right to fight the gypsy moth by aerial spraying. Individual rights in such cases must yield to the requirements of the public as a whole.

The court's decision, upheld last year by the U. S. Supreme Court, illustrates how modern law emphasizes the rights of society as against those of the individual. As the Supreme Court stated in a 1946 case, "It is ancient doctrine that, at common law, ownership of the land extended to the periphery of the universe. . . . But that doctrine has no place in the modern world. The air is a public highway."

Does that mean a property owner has no control over the space above his ground? Not at all. To quote the Supreme Court again: "The landowner owns at least as much of the space above the ground as he can occupy or use in connection with the land."

Here, then, are two basic legal principles to keep in mind. You cannot restrain a national, state, or local government agency from any legal activity which it has reasonably decided is for the benefit of the community as a whole. You cannot prevent the federal government from doing things such as spraying your land to control insects. You cannot obstruct the state in such activities as taking your land (on payment of just compensation) to build a highway. And you cannot stop your local government from doing such things as trimming your street trees in the interest of public safety.

You *can* prevent anyone from building a structure that would overhang your property. Or, after he has built it, you can sue to make him remove the overhanging part. You can also sue to compel a neighbor to remove the branches of trees or the growths of shrubs, vines, or other plants that encroach upon your property. Or you can remove them yourself, at the property line, provided you cause no unnecessary damage. (The fruit,

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wood, and other useful parts of an encroaching branch, however, belong to the owner of the tree, and he's entitled to them if you sever the branch.)

A suit over an encroachment may seek to stop its continuance and also to recover any loss which it has caused. In a 1953 federal case the defendant used planes to apply DDT and the dust drifted over to the plaintiff's property. The plaintiff claimed that it had caused injury to his crops and annoyance to himself and his family. Here, too, the court decided against the plaintiff, but solely on the ground that he had not proved that the dust had caused actual injury.

If, on the other hand, a landowner can show that spraying or dusting, or any similar action, has caused actual damage, there is no doubt that he can obtain legal relief and recover his losses.

He can also recover actual losses caused by a public or private agency acting without authority, exceeding its authority, or failing to use reasonable care.

If it can be proved that a spray material is defective, the seller of the material is liable. In a 1957 Federal case a landowner recovered over $130,000 for damage to his peach orchards caused by defective sprays.

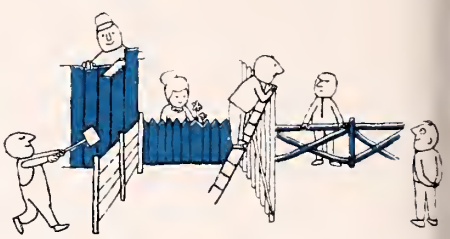
Nuisances

One of our most ancient legal maxims is actually the law's counterpart of the Golden Rule: *Use your own property so as not to injure that of another.*

There are many ways a person may invade or injure another's use and enjoyment of his property. He may interfere with the physical condition of the land itself, as by vibration or blasting. He may destroy plants by smoke or chemicals, flooding, or the pollution of a stream. He may disturb his neighbor's comfort or convenience by unpleasant odors, smoke, gas, or loud noises; or he may endanger his health by maintaining a pond full of mosquitoes. He may disturb his neighbor's normal peace of mind simply by using his property for illegal or immoral purposes.

In any such cases, which involve what the law calls nuisances, the main legal point is whether the offending party has used his land in a *reasonable* way. What a court considers reasonable depends upon the circumstances of each case. "A nuisance," the Supreme Court has explained, "may be merely the right thing in the wrong place—like a pig in the parlor." The character of the neighborhood usually determines whether conduct complained of is unreasonable.

Neighborhood character may also affect contract rights. If the deed to your property includes restrictions on the ways you may use it or the kinds of structure you may build on it, you are bound to abide by the restrictions as long as the neighborhood retains the character which the restrictions were intended to perpetuate. But where neighborhoods change substantially, courts usually do not enforce such restrictions. So if your deed forbids you to put up a fence, you can't build one as long as there are none in the area. But if other people in the area, who have no such restrictions in their deeds, start putting up fences, then you are not likely to be stopped from putting up a fence of your own.



Fencing yourself in? Better take a look at your deed and at zoning laws

Motive or intent may also be important in nuisance cases. Where the offending party acts out of pure malice or spite toward his neighbor his conduct is illegal. Cases on record of this kind include building a fence for the sole purpose of shutting off a neighbor's view, firing a gun to interfere with the breeding of domestic animals, and leaving a kitchen door open

solely to annoy a neighbor by the smell of cooking onions.

It's worth noting here that the law itself is not unreasonable or arbitrary in matters of this kind. It insists that the test or criterion of a nuisance is whether the annoyance in question would disturb a person of normal, ordinary sensibilities. It is not concerned whether it would upset a nervous, hypersensitive individual or whether it would offend a fanatic or enrage a crank.

But, in the meticulous language of a Maryland case, "any habitual noise (whether produced by skilled musicians or domestic animals) which is so loud, continuous, insistent, not inherent in the character of the neighborhood, and unusual therein, that normal men, women, and children, when occupying their own homes, are so seriously incommoded that they cannot sleep, study, read, converse, or concentrate until it stops"—that definitely is a nuisance!

To provide relief in such a case a New Jersey court last year ordered a country club to reroute its golf course to eliminate the constant noise of players near the plaintiff's house. "It awakened them and their children," said the court, "as early as seven in the morning and it pervaded their home all day long until twilight."

Here are some more basic principles worth remembering:

Your neighbor cannot prevent you from using sprays, dusts, weed-killers, and fertilizers, as long as he cannot prove that you have used them unreasonably, that their use is alien to the neighborhood, that your use of them has actually damaged or prevented him from enjoying his property, or that it has injured him or his family. But if he *can* prove any of these things, he probably has a case.

There's nothing he can do about the noise caused by the reasonable use of a power lawn mower, garden tractor, chain saw, or the like, or the reasonable, normal sounds of conversation, mirth, and music of an occasional outdoor gathering. But if you make a fetish of tuning up your lawn mower engine, and run it all day long every weekend while you adjust the carburetor, or timing mechanism, or if you have frequent, loud, all-day or all-night parties, our neighbor may have good enough reason to sue.

If you grow roses and your neighbor develops an allergy to them, his only legal recourse is to put up with it or move away. But if, for the obvious purpose of spiting him, you should plant your entire

Your neighbor allergic to your rose bushes? Does he have legal recourse?

property with roses, he'd be justified in taking you to court. And you or anyone else would be justified in taking him to court if he should hedge his property with poison ivy!

Trespassing

Closely related to the legal principles involving a property owner and his neighbors are those pertaining to people who come onto his land.

Trespass, in Blackstone's words, is "entry on another man's ground without a lawful authority, and doing some damage, however inconsiderable, to his real property." It is a violation of the owner's right to "retain to himself the sole use and occupation of his soil." Relief from trespass can be obtained by court action, and recovery can be secured for any damages that can be proved.

However, where trespass has been openly and continuously permitted for a long time—usually 20 years—an "easement by prescription" may be claimed, with the result that the owner may be legally deprived of his right to prevent the trespassing.

To persons who enter upon land without consent, the owner's obligations are negligible. Intruders have no right to demand a safe place to trespass. As a general rule, the owner is not liable for injuries to trespassers, even if caused by his failure to use reasonable care in keeping his land in safe condition.

But there are certain exceptions to this general non-liability. The owner is not free to inflict intentional injury upon a trespasser, and so it would be illegal for him to set traps or other devices intended

When old Rover chews up your neighbor's laundry, is it your loss?

to inflict bodily harm. Also, if he actually knows of frequent trespasses, there may be a duty to warn of a highly dangerous condition, such as a high-tension electric cable, particularly if it is not likely to be noticed.

Beware of Children!

Most courts also make the landowner liable for conditions that are dangerous to children if any form of allurement can be shown. Liability here comes under the "attractive nuisance" doctrine. In the words of Supreme Court Justice Holmes, "Knowingly to establish and expose, unfenced, to children of an age when they follow a bait as mechanically as a fish, something that is certain to attract them, has the legal effect of an invitation to them." Thus, a landowner was held liable for the drowning of a trespassing child where he did not fence a pond containing sticks with which children were in the habit of "playing boats."

Since parents, as a general rule, are not legally responsible for the wrongs of children, courts do not usually hold them liable for damage done by their trespassing children. But if it can be shown that a child has a habit of doing a certain kind of mischief, that the parents knew of this, and that the habit was responsible for damages caused by the child while trespassing, then the parents are liable. They are liable, also, if the child causes damage with their prior knowledge or consent.

It's a Dog's Life

Trespassing domestic animals are subject to legal principles similar to those applying to trespassing children. If a neighbor's dog comes onto your property and injures a member of your family or does substantial damage, the owner, at common law, is not liable if this is the first time the animal has been known to act this way. But if the dog has done similar injury or damage before and the owner knows of it, then he is responsible.

In localities where statute law prescribes that dogs must be tied up, the owner is responsible if his pet gets loose and causes damage.

All domestic animals are regarded as personal property, so you may not injure another man's trespassing dog except in defense of yourself or another person. Where dog licensing is required by statute, however, courts sometimes hold that an unlicensed dog is beyond the protection of the law and that its owner therefore is not entitled to recovery for its injury.

Come on to My House

A property owner's obligation to people who come onto his land as guests is only slightly greater than it is to trespassers. There is a duty to warn of a dangerous condition if it is known, but beyond this the law does not go.

In a recent New Jersey case, a guest was injured by the collapse of a bench she was sitting on in the defendant's garden. It was one of several pieces of furniture he had made himself a few years

before. But the guest was denied recovery because she could not prove that the owner knew the furniture was in poor condition.

Toward people who come onto his property on business, however, the owner must assume a greater degree of responsibility, and his negligence may make him liable for their injuries. Hence, if a milkman is injured by the collapse of your neglected back steps, or a hired gardener by the caving in of your poorly maintained rose arbor, there's every likelihood that you'll be held liable.

Lend Me Your Mower

Negligence may also be a factor in the renting or reciprocal loaning of garden equipment. If you and your neighbor

A chair collapses under your guest. Can he sue you for his injuries?

borrow each other's equipment, or if you rent it from a dealer, you are legally obligated to take care of it while it's in your possession. If it is damaged by even your slightest negligence, you are liable. But if you can show that the damage occurred through no fault of yours, there is no liability.

If you injure yourself or damage your property while using borrowed or rented equipment, it is ordinarily no one's loss but your own. But if the equipment is defective, and if the owner knew it but neglected to warn you of it, then he is responsible for damages caused by the defect.

Also, if you borrow or rent equipment, you are not entitled to lend or rent it to a third party without the owner's consent. If you do, and the third party damages it, the responsibility is yours.

Where Did You Learn Your Trade?

If you hire a person who claims to be a member of a profession, you have a legal right to expect him to use reasonable care and skill. If he damages property, you can charge malpractice and recover your loss, provided you can prove he did not possess the necessary learning, experience, and skill, that he did not use reasonable care, or that he used practices not recognized by his profession. Thus, if a professional gardener kills your plants by spraying them with 2,4-D, you can sue him, whether his use of this weedkiller was due to ignorance, carelessness, or his belief that as used by him it would be good for the plants.

Most instances of what you may consider malpractice, however, would be much harder to prove. And if such damage is done by either a boy or a man who makes no pretense of being a professional, you definitely cannot hold him liable—unless you can prove he acted knowingly and intentionally.

Let's Be Friends Anyway!

In its application to gardens, as to most other things, the law is no more than what Samuel Johnson called the result of human wisdom acting upon human experience. And so it's always best to temper the letter of the law with common sense. True, there are limits beyond which violations of legal rights should not be tolerated. But most legal problems arising from a property owner's relations with neighbors, friends, and tradesmen can best be settled by discussion, compromise, and agreement. (And here your knowledge of legal principles is sure to stand you in good stead!) Only as a last step should you resort to litigation, with all its inconvenience and expense.

CAN ANYTHING AT ALL GROW THERE?

An English gardener points the way toward seeking out suitable plants for difficult places

E. C. M. Haes

Reprinted from the *Gardeners Chronicle* (London), September 16, 1961*

MOST gardens have one or two really awkward corners where it may seem that any worthwhile garden plant would have very little hope of surviving.

There are three main problem sites, and there are decorative plants which may be grown in them all. The choice is limited, certainly, but too often these sites remain unfilled when they could be both pleasing and interesting features.

The first place I have in mind is the dark, dark corner that usually lies around the back door or behind sheds. The second is the root-dried soil beneath vigorous trees or hedges, and the third is the top of an old brick or stone wall that for some reason or other cannot be removed and is not worth repairing.

Firstly, the sunless, forgotten corners. Ferns are an obvious choice but certain flowering plants will also grow fairly well in them. For the ferns, work crushed charcoal and screened leaf-mold into the stale soil when planting. Use about half a bucketful of the leaf-mold, well sprinkled with coarse charcoal, for each plant.

For the varieties named in the original Haes article, for growing in England, Miss Alys Sutcliffe of the Brooklyn Botanic Garden Staff has substituted varieties that are known to be successful over large areas of the U. S. and Canada. Miss Sutcliffe's partial revision follows.

Evergreen ferns are, I think, the most satisfactory kinds to choose. Of these Christmas fern (*Polystichum aerostichoides*) is pleasantly ornamental for massing in shady or partially shady places; it grows 9″ to 18″ tall. A lower growing evergreen fern is the common polypody (*Polypodium vulgare*). This will grow anywhere in the shade over rocks or roots.

Some of the best deciduous ferns for dull places are the innumerable varieties of the vigorous but graceful lady fern (*Athyrium filix-femina*). Not only are these varieties with foliage wrought into fantastic but always pleasing shapes, but some also have foliage of the palest lettuce-green. An example is *A. f. plumosum*. It is magnificient when grouped along with the more normal dark green types. In a moist shady place one of the most attractive of the deciduous ferns is maidenhair (*Adiantum pedatum*).

Flowers for dark places are rather unobtrusive types, but they all associate well with ferns to make an excellent composite feature. Fumitory (*Corydalis lutea*) is a good illustration of this type. Several violets are reliable, such as the vigorous dwarf, pink-flowered *Viola arenaria rosea*. In climates which suit it, *Viola odorata* is very good indeed. Exceedingly valuable for brightening dull places is the rampant but worthwhile woodruff (*Asperula odorata*), which carries heads of glistening tiny white tubular flowers. Some of the dicentras may be added to the list. Mountain bleeding heart (*Dicentra eximia*) is a gay little plant which will seed itself and flower off and on all summer. It has fern-like foliage and bright pink flowers. Also for growing with ferns are squirrel corn (*Dicentra canadensis*) and Dutchman's breeches (*D. cucullaria*), whose flowers are white tipped with yellow. For plant-

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ıg with the taller ferns, try the well nown garden bleeding heart (*Dicentra ıectabilis*) that does so well in the shade nd in the woodsy soil that ferns thrive in. everal cyclamens (particularly *C. neaolitanum* and spring-flowering *C. reandum*) thrive in almost total shade, long with the spectacular trilliums, for xample, *Trillium grandiflorum*. These ıoicer plants, however, need deep, rich)il and are perhaps rather too valuable to e used in obscure parts of the garden. ut for really bright effects, try the varigated periwinkle (*Vinca minor variegata*) or the even more conspicuous prosrate variegated *Euonymus radicans ariegatus*. The neat little English ivy, *'edera helix tricolor,* is another useful lant for the purpose, and so is *Pachyındra terminalis variegata.*

For dry, shaded places under trees, most ? the flowering plants mentioned above with the exception of trillium), together ith hart's tongue and common polypody rns are very satisfactory.

For decorating crumbling masonry there e many suitable plants. In wet, mild cliates small ferns like some of the spleenorts are good.

It is here that houseleeks and stoneops come into their own. Unquestionably ıe most pleasing houseleeks for very dry all crevices are the cobwebbed forms of *empervivum arachnoideum.* Another orthwhile kind is *Sempervivum tectorum iste,* with brown-purple leaves. Useful ıd showy stonecrops that are superb for all tops and crevices are varieties of *edum album* and glaucous-leaved *S. caucolum*—valuable for its pink flowers in ıtumn.

A plant which may be established in difult places is the familiar Kenilworth ivy *Linaria cymbalaria*).

In some situations in the United States ıd Canada vines are the only plants hich will thrive. A well-rooted vine will uickly cover unlovely walls. The following are suggested for shaded areas: English ivy (*Hedera helix*), especially its small-leaved varieties, and Boston ivy (*Parenthenocissus tricuspidata*). For more open places, try trumpet vine (*Campsis radicans*), sweet autumn clematis (*Clematis paniculata*) and American bittersweet (*Celastrus scandens*). The latter can become a pestiferous escape in any nearby wooded area.

Epimediums have been used surprisingly little as ground covers for which these attractive plants are exceptionally good. They grow best in shade and once established will spread over the ground and between rocks. They die down to the ground in winter, but the strong little rhizome-like surface roots hold the soil in place. The delicate flowers on slender wiry stems come in late spring, and are followed by a soft green or bronzy foliage which is attractive all summer. *Epimedium grandiflorum liliacium* is a strong grower and has slightly larger foliage than other varieties. *E. niveum* is a strong grower with masses of white flowers, and *E. pinnatum elegans* has yellow flowers. *E. rubrum* has, I think, the richest flower color (ruby red), with bronze foliage. *E. sulphureum* is another good yellow. It is difficult to say whether any one variety of Epimedium excels all others as a ground cover that will grow almost anywhere.

For a dry sunny spot with poor soil, try a clump of hardy bamboo (*Pseudosasa japonica*). Also, the ornamental grasses such as blue lime grass (*Erianthus ravennae*) or fountain grass (*Miscanthus sinensis gracillimus*)— formerly called *Eulalia sinensis gracillimus*—can be very effective.

A. B. Morse

the deep shade and dank soil commonly und at the base of a north facing wall, e interrupted fern (*Osmunda claytoniana*) makes a lush border of lacy foliage

OLD TULIPS WITH A CONTINUING PURPOSE

Condensed from *House & Garden*, November, 1961

GARDENING is full of paradoxes, one of which is the way tulip hybridizers are looking over their shoulders at the past, while resolutely changing the shape and form of the future. Not that today's tulips lack either variety or good looks; they are only a mild prophecy of what tomorrow's tulips will be. It has taken several centuries for tulip breeders and gardeners alike to get far enough away from the past to look at it objectively and appraise it at full value.

Over the centuries, the great desire has been for new forms and sensational colors. This we have gotten, but at a considerable cost. Much of the delicacy and almost all the durability of the original tulip species (most of them native to Asia, the Middle East and the environs of the Mediterranean) were lost in the hybridizing shuffle. Because of the proliferation of new "hybrid" varieties, and because gardeners were unwilling or unable to take the necessary pains to ensure long life for their bulbs, tulips came to be treated as one-season flowers. To th day, it is a rare gardener who can g two successive years of comparable beaut from a single planting of the big garde tulips.

Does this mean that today's tulips a no good? Certainly not. What it do mean, however, is that in sheer mag nificence—of both form and color—t day's tulip varieties have just abou reached their limit. They are at their be the first year after planting, diminishin almost always in vigor each succeedin season. Only the captious doubt that th kind of seasonal display is worth wha it costs. But that is beside the point- because at the crest of the spring seaso what other flower can match the tulip?

Breeders know, and gardeners are no finding out, that something much bett is in the making. This something bett is based on a new appreciation for mar original tulip species—not only for the garden value, which had been largely lo sight of until comparatively recently, b

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T. kolpakowskiana, red-striped gold

T. turkest white min

T. biflora, white stars 5 inches high

T. praestans, red clusters
10 inches high

T. clusiana,
white and red

T. eichleri, bright
red and gold

T. fosteriana, biggest,
boldest red

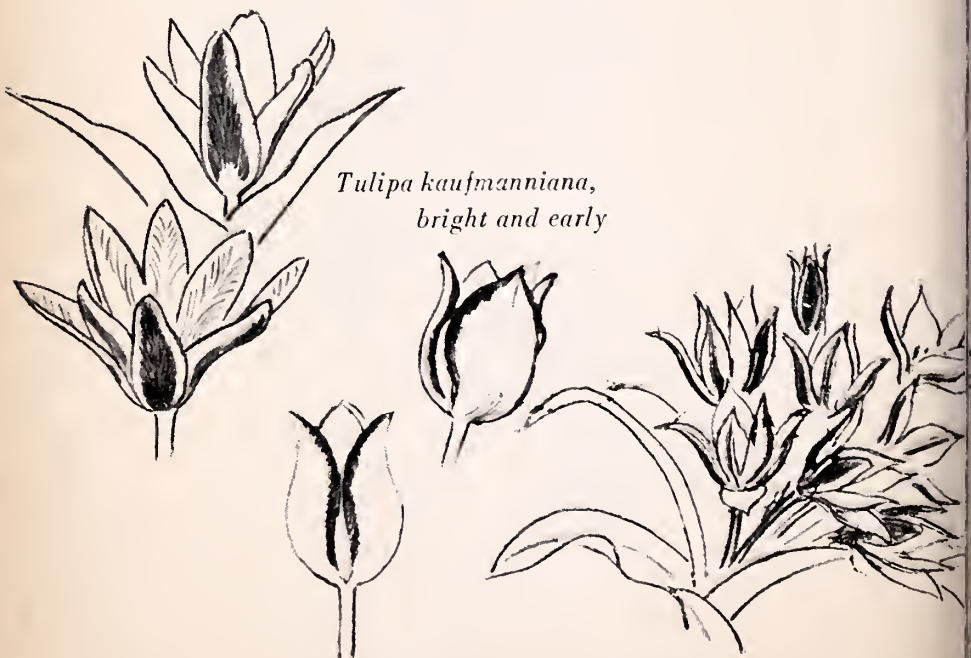
for their potential as a dominant parent of tomorrow's tulips.

The drawings on these pages show some of the most desirable tulip species, all available from dealers today, that have remained beautiful and long-lived flowers since gardening's dark ages. To the new tulip hybrids that resemble, in their statuesque form, large blossoms and brilliant colors, the familiar Breeder, Cottage and Darwin varieties, something has been added which does not show on the surface. Into these tulips, hybridizers have injected the blood of some of the hardiest old-timers. These new tulips contain some of the most notable characteristics of the original species: the bulbs have a resistance to deterioration, resistance to disease organisms that can decimate a tulip planting in a few years, and ability to multiply, once planted in a favorable location.

Every flower form, every growth characteristic, every pattern of petal and leaf is already present in some species or variety of tulip that is available today. What the future has still to produce is new combinations of all these characteristics, to give us such innovations a graceful multiflowered types with th height of Single Earlies and larger flow ers, giant-flowered Fosteriana hybrids i soft pastel colors, and a whole range o pink and lavender added to the red Greig clan.

Tomorrow's list of tulips will includ all these and many more. But what d you, the gardener, do in the meantime You make greater use of the tulip specie and their newly developed hybrids tha you ever did before. You plant ther where (and to much the same purpose you plant daffodils and other early bulb with which they flower.

Today's tulips, with an invisible touc of tomorrow, will accommodate them selves for many seasons in a wide rang of soils and growing conditions. Amon the new ones are: 'Bokhara,' a Greig hybrid, orange-red; 'Greenland,' its old rose and green petals harking back t *Tulipa viridiflora;* and 'Gudoshnik,' magnificent Darwin-Fosteriana hybrid i gold and rosy pink.



Tulipa kaufmanniana, bright and early

T. marjoletti, palest rose and gold

T. tarda, clusters of white and yellow

The Place—It is Simply So

Jane B. Cheney

ONCE upon a time down in the swamp where it is very beautiful and busy in the springtime, a Mother and Father Teal made their nest of grasses and rushes. As the days passed by, two eggs arrived in the nest and were lovingly brooded by the parents.

Mother and Father Teal were very happy when the eggs hatched. They brought the best food they could find for the babies. They hovered over them and kept them warm. But there was no denying it, one baby grew stronger and more beautiful than the other. No matter what Mother and Father did, there they were, a big, strong healthy baby and a little, ugly baby. Many evenings when the sun went down and the babies were asleep, Mother and Father would quack to each other in very low voices. . . .

"What do you think we ought to do?" "Perhaps he needs some roots of the sweet flag." "Do you suppose the duckweed in the next pond is better?" "Should we move there?" "Perhaps Dr. Owl will give us some advice."

But nothing did any good.

We will call the ugly duckling Eddie and the handsome baby Sammie. Well . . Sammie began to notice that he was bigger than Eddie. He began to push and shove and put his bill out for food in a very greedy way. Once he shoved Eddie so hard that Eddie fell out of the nest.

"You're so little, Eddie," he quacked. "You can't do anything. See how I can flap my wings! You're just a sissy, and ugly as ugly."

"Sammie!" scolded Mother. "Stop that. It's not Eddie's fault that he isn't strong. You are a cruel brother to tease him so. He cannot help his looks. Besides, I think he is beautiful and Father does too. We love both our boys."

Mother told Father Teal what had happened when he came back from his next trip. "Sammie *must* learn to be kind to Eddie," she said.

"Yes," said Father. "But that's not the whole answer. Eddie is not strong, but he cannot expect every duck in the world to go easy on him. They won't, you know. I think it is time to take Eddie to the Place."

"Do you think he is old enough?" asked Mother fearfully. "He is so little. He is only a baby, really. The Place can be very cruel."

Eva Melady

"He is old enough," said Father. "Besides, the Place is not cruel. It is simply SO. Everyone has to go there sooner or later. The younger you are, the easier it is afterwards. Eddie is weak and he is homely. But his eyes are sharp and his heart is strong. My father took me to the Place and his Father before him. I will take Eddie. That is what Fathers are for. You will walk just a little behind, and if he is afraid, he can run to you. That is what Mothers are for."

So they went to the Place. They went on foot through the tall reeds, across the hummocky grass, over the strip where the sand shakes; because they had to go, and the way is never easy. Father went first, Eddie followed, and Mother was always there to help and comfort and to give a little push now and then. It can be a wonderful trip this way. It is very sad when a little duck has to make the trip all by himself. It is even sadder when he has to go alone after he is grown up.

At last Father stopped. "Eddie," he said, "this is the Place. You must go ahead of me now, by yourself. Mother and I will be right here. Do not be afraid of the Place. It is simply SO, that is all. It cannot hurt you, though you can hurt yourself on it."

Eddie waddled on, a little slowly and timidly. He looked down for a long while at the Place. When he raised his eyes, he found Mother on one side and Father on the other. He looked down again.

"I am small," he cried. "I am small and weak and homely."

"Yes, darling," said Mother softly. "But it doesn't matter at all."

"I will always be this way," said Eddie. "I will never be beautiful."

"No, my dear son," said Father. "You will never be beautiful. But Mother is right. It doesn't matter at all. If your eyes are bright and your heart is strong, nothing can hurt you beyond your strength."

"And I will never be the fastest swimmer, nor the best flyer, nor the loudest quacker." said Eddie sadly.

"No," said Mother. "I'm afraid not. But you can be the best smiler and the kindest teacher and the most loving Father for your babies. Those are the hardest things you know, Eddie. Anyone can fly and swim and quack if he is strong. It is very hard to be a lovely duck if you let yourself get in the way."

"Yes," said Father, "You must learn to wear your inside on the outside. Then everyone will see WHO YOU ARE."

Eddie looked down at the Place.

"I can see the sun shining," he said at last. "And the white clouds are floating in the water. It is really a beautiful day, isn't it?"

"Eddie," said Father, looking off across the Place into the tender, green thicket beyond—"Eddie, didn't you ever notice it before? I have only one foot you know, and your Mother has no blue on her wings."

"No," said Eddie, wonderingly. "No, I never noticed. I thought that was the way all grown up ducks walked. And I loved you even if you do have only one foot."

"That's what I mean," said Father. 'My inside which is full of love and care 'or you covers my outside, so my foot loesn't show. And Mother's love and care ides the no-blue on her wings. Now hat you know what you look like on the utside, you will have to learn to wear our inside like a beautiful feather cloak. Then you will be the same all the way hrough. Just be sure that you keep our inside shiny and well pressed, that's ll."

"It is the most beautiful day I have ever seen," said Mother softly.

And it was, the most beautiful.

• • • •

Father, Mother and Eddie went back to the nest. Behind them the still, quiet pool smiled at the sky. A leaf from the elder bush dropped onto the water, and with a sudden shiver, the mirror surface trembled. Then it was still again.

The Place can be very beautiful, you know.

It is simply SO—that is all.

• • • •

PRAYER OF THE TREE TO THE WAYFARER

YE who would pass by and raise your hand
against me, hearken ere you harm me.
I am the heat of your hearth on the cold
winter nights, the friendly shade
screening you from the summer sun;
My fruits are refreshing draughts quenching
your thirst as you journey on.
I am the beam that holds your house, the
board of your table, the bed on which
you lie, and the timber that builds
your boat.
I am the handle of your hoe, the door of
your homestead, the wood of your cradle
and the shell of your coffin.
I am the gift of God and the friend of
man.
Ye who pass by listen to my prayer——

HURT ME NOT.

Reprinted from the *Journal of the Botanical Society of South Africa*

WORTH READING

A Supplementary List of Significant Articles, Bulletins and Books Published During 1961

ARTICLES AND BULLETINS

Methods and Techniques

Fluorescent Light Gardening. Elaine C. Cherry. *The Gloxinian,* September-October. A comprehensive, up-to-the-minute treatment of equipment and culture, with technical information provided by Norman J. Cherry.

Growing Ferns from Spores. Thorlief Fliflet. *American Fern Journal,* July-September. A detailed article aimed at the amateur.

Foliar Feeding, a Milestone in Plant Nutrition. Extracts from "The Contribution of Atomic Energy to Agriculture," testimony given by H. B. Tukey before a Congressional committee, published by the Ra-Pid-Gro Corporation, Dansville, N. Y. An illustrated report which explains in simple terms the principles of applying nutrients directly to plant leaves. Copies available without cost.

Soil Management for Mum Gardens. Warren K. Schoonover. *National Chrysanthemum Society Bulletin,* April. An Extension Soils Specialist makes detailed recommendations.

Results of Tests in Controlling Japanese Honeysuckle. S. Little. *The Hormolog* (Amchem Products, Ambler, Pa.). Most effective is chemical spraying in June for three successive years, with later attention to seedlings.

What's Next in Weed Killers. *Farm Journal,* May. Surfactants, which are detergent-like compounds, are one of the newest additives that make some of the chemical weed killers more effective. Weed-killing granules spread on fields by airplane is another of the developments reported.

Lawns, Ground Covers

If You Must Start Your Lawn This Spring . . . Theodore A. Weston. *American Home,* April. Concise directions for overcoming the disadvantages of not having started in the fall.

Making and Maintaining a Lawn. Robert W. Schery. *American Horticultural Magazine,* April. A practical approach for the owners of both new and old lawns.

Unusual Ground Covers. Arthur Edwin Bye. *Landscape Architecture,* October. Native plants are suggested for easy maintenance.

The Outdoor Garden

Gardening by the Sea. Louise Dawson. *Flower Grower,* July, August; Victor Greiff, September. Emphasis is placed on plants that will tolerate both wind and salt. Suggestions are based on the authors' own gardens.

New Azaleas Add Soft Color. David G. Leach. *The New York Times,* April 16. America's new Gable and Pride hybrids and the hardier of the Glenn Dales, plus Exbury and Knap Hill and other English introductions are recommended over the shrubs of more violent color that are commonly seen in the suburbs in spring.

Flower Fragrance Through the Year in the Scented Garden. Mary McFarland Leister. *Flower Grower,* May. Fifty fragrant plants, cultural directions, and three garden plans.

Grow Cacti and Succulents Outdoors. Ladislaus Cutak. *Horticulture,* July. Encourages cultivation of desert plants in cold as well as frost-free climates.

New Fruit Varieties. John Einset, George L. Slate and John Watson. *Farm Research.* New York State Agricultural Experiment Station, Geneva, N. Y. Two new Muscat grapes, two strawberries, and a purple raspberry are being introduced as a result of breeding work at Geneva.

Plants Indoors

Enter the Wonderful World of the Indoor Garden. *Flower Grower,* November. An 18 page feature with many photographs and suggestions for decorating the home with plants.

uggested Pot Plant Procedure. John C. ortelroy. *National Chrysanthemum Society ulletin,* October. Exact dates given for mak-ıg cuttings, planting, pinching and, when esired, shading, to give blooms Oct. 10-20 ı Long Island.

Conservation

lelp Keep Our Land Beautiful. A 16-page aflet in which a family, while traveling, arns about devastation of the land and hat can be done to protect our soil and her natural resources. Available at 20 nts each (less in bulk) from the Soil onservation Society, 838 Fifth Avenue, Des oines 14, Iowa.

esorts or Wilderness? Devereux Butcher. *tlantic Monthly,* February. A plea for eeping sports facilities, excess buildings, ıd commercial roads out of our National arks. Reprints available at 10 cents each om National Wildlands News, 2607 Con-ecticut Ave., Washington 8, D. C.

Some Useful Lists

ealers in Native Seeds and Plants. *Wild lower* (Wild Flower Preservation Society, 40 Oliver St. N.W., Washington 15, D.C.). list of dealers in native plants and seeds.

Hobbyists Join Plant Societies. *Flower Grower,* April. A list of special plant societies with their addresses.

These Are the Champs. Dorothy Dixon. *American Forests,* January, February. Statistics on the largest representatives of native American trees noted since the last list was published by the American Forestry Association in 1956.

Of General Interest

Speak to the Earth. *Natural History,* June-July. Plants of the Bible in magnificent watercolors by Ann Ophelia Todd occupy the four center pages and the cover of the magazine. Other pages have black-and-white illustrations to accompany the text.

Exploring for Wild Narcissus. Frederick G. Meyer. *The American Horticultural Magazine,* April. Describing plants collected in the Mediterranean region for the U.S. Department of Agriculture and Longwood Gardens, to be used in breeding for improved forms and more resistant stock.

European Rose Trials and Gardens. J. A. Armstrong. *American Rose Magazine,* September. Impressions of rose shows, trial gardens, and rose breeders during a four-month European tour.

BOOKS

Gardening and Landscaping

ıylor's Encyclopedia of Gardening. Nor-ın Taylor, editor. Fourth edition, com-etely revised and enlarged. 1,329 pages. oughton Mifflin, Boston. $15.

Cross references in abundance make infor-ıtion easy to find. Included in alphabetical quence are such topics as garden planning d design, soils and soil operations, plant eeding, kitchen garden, and other special-ed plantings. New color plates show rden flowers, shrubs and vines, different ıds of plantings, regional aspects of gar-ning, indoor plants, garden structures, and wer arrangements, all bearing references articles.

01 Answers to Your Florida Garden Ques-ns. Herbert S. Wolfe and others. Uni-sity of Florida Press, Gainesville. $5.

An especially helpful book for northern-commencing southern gardening.

Carefree Gardening. Jean Hersey. 191 pages. Van Nostrand, Princeton. $4.95.

Operations are reduced to a minimum with durable perennials blooming like wild flowers in a meadow, annuals reseeding themselves, bulbs increasing without disturbance, and vegetables benefiting from deep mulches.

Gardening Without Work. Ruth Stout. Devin-Adair, New York. $3.95.

An expansion of "How to Have a Green Thumb Without an Aching Back."

Gardening the Easy Way. Edwin F. Steffek. 198 pages. Holt, Rinehart & Winston, New York. $3.95.

A general guide for gardeners.

The Green Thumb Garden Book. George Abraham. 344 pages. Prentice-Hall, Englewood Cliffs, N. J. $4.95.

A paragraph on "Green Thumb Care" accompanies each plant description. Many lists of plants are given.

The Complete Guide to Garden Flowers. Herbert Askwith, editor. 256 pages (9 x 12), 1,000 color illustrations. A. S. Barnes, New York. $12.50.

Plants are treated alphabetically by common name, along with articles on garden planning.

Your Garden in the South. Hamilton Mason. 358 pages, photographs, maps, 16 pages in color. Van Nostrand, Princeton. $7.75.

Basic gardening plans and practices for warm climates. Helpful lists include plants unsuited to the region covered.

Gardening in South Texas. P. A. Renton, Jr., H. R. Newcomer and Roy C. Bates. 159 pages. Naylor, San Antonio. $3.95.

Practical guidance on selection and culture of plants in the region of San Antonio.

Your Guide to Florida Landscape Plants. John V. Watkins. 293 pages. University of Florida Press, Gainesville. $6.50.

Descriptions and drawings of 281 species of "trees, palms, shrubs, vines." Classification and requirements of each treated under twenty headings.

Gardens in Winter. Elizabeth Lawrence. Drawings by Caroline Dorman. 218 pages. Harper, New York. $4.50.

Even without flowers, a garden takes on new beauty in winter when seen through the eyes of this observant writer.

Special Groups of Plants

Flowering Trees of the World for Tropics and Warm Climates. Edwin A. Menninger. 336 pages (8x10). 425 color plates. Hearthside Press, New York. $18.95.

The greatest assemblage ever made of descriptions and colored illustrations of the world's handsomest flowering tropical trees. Introductory chapters tell of the author's search for these beauties, many of which he has already introduced into cultivation in Florida and other warm regions. Drawings in the text are by Eva Melady.

The Complete Book of Lilies. F. F. Rockwell, Esther Grayson and Jan de Graaff. 352 pages, illustrated partly in color. Doubleday, Garden City, N. Y. $5.95.

Descriptions of lily species and hybrids conclude this book, which in previous sections covers mainly the culture, propagation, and breeding of lilies. The many lists in the appendix give information of added value.

Rhododendrons of the World and How to Grow Them. David G. Leach. 544 pages (9 x 12), illustrated. Scribner, New York. $25.

Rhododendrons and azaleas are described in the alphabetical order of their specific names. A large folded-in sheet shows their relationships. Chapters cover rhododendrons in the wild and in gardens, planting, and caring for the plants, also propagation and breeding. A 75-page list gives the parentage and breeder of each known hybrid.

The New Perennials Preferred. Helen Van Pelt Wilson. 320 pages illustrated. Barrows, New York, $4.95.

Since the first "Perennials Preferred" was written in the mid-forties, the author's taste in gardens has veered toward the informal. Planting plans and lists of recommended plants are abundant. Chapters cover principles and practices and favorite groups of plants.

Miniature Roses. Roy Genders. 104 pages, 10 color illustrations. St. Martin's Press, New York. $3.95.

Culture in mild climates, propagation and uses are covered.

Miniature Trees and Shrubs. Anne Ashberry. 158 pages; photographs and drawings. Dufour Editions, Chester Springs, Pa. $4.95.

Conifers are the chief miniatures described, with roses and other shrubs given secondary attention.

A Fresh Herb Platter. Dorothy C. Hogner. 237 pages, illustrated by Nils Hogner. Doubleday, Garden City, N. Y. $3.95.

Plans for herb gardens and practical planting directions (including number of plants required) precede tantalizing recipes.

Garden Shrubs and Trees. Sydney Gerald Harrison. 318 pages, 73 drawings; 15 color plates by Ann V. Webster. St. Martin's Press, New York. $4.95.

One of five Kew Series volumes. While slightly more technical than most American books for the layman, all terms are amply explained and the descriptive text is informative.

Cacti. Walter Kupper and Pia Roshardt. Translated and edited by Vera Higgins. 128 pages. (8 x 11½). Thomas Nelson, N.Y. $15.

Sixty full-page color plates are accompanied by a smooth-flowing text. Cultural information is given in footnotes.

lome Orchid Growing, second revised edi-ion. Rebecca T. Northen. 320 pages (8½ x 1), 13 color plates, 160 other illustrations. an Nostrand, Princeton. $10.95.

Cattleyas and other major groups of or-nids are treated comprehensively. Many iniatures are described under "Collector's ems." Botany, mineral nutrition, and or-nid ailments are among other topics cov-ed.

rchids—Their Botany ond Culture. Alex awkes. 297 pages, 150 photographs and awings. Harper, New York. $6.95.

Cultural directions are given for orchids each of the 100 genera treated. An ap-nded list of 668 genera shows orchid re-tionships.

nder's One-Table List of Orchid Hybrids. ol. 1—1946-1960. 578 pages. David San-r's Orchids, Ltd., Selsfield, E. Grinstead, ussex, Eng. Approximately $10.00.

More than 15,000 hybrids are listed in genera. Parentage, introducer and date e given.

he Golden Guide to Lawns, Trees and rubs. John Strohm, editor. 176 pages, 32 color. Golden Press, New York. $1, paper.

Companion volume to "The Golden Garden nide," written by seven experts and illu-rated with helpful drawings on every page. l sections of the country are considered.

Gardening Techniques

ant Pruning in Pictures. Montague Free. 6 pages. Doubleday, New York. $4.95.

Abundant photographs and a brief but nple text combine to make every procedure pruning seem sensible and clear. Many ustrations show results of both good and d work effectively.

ie Lawn Book. Robert W. Schery. 207 ges, drawings and photographs. Macmil-n, New York. $5.95.

A practical book with "Regional Focus" ragraphs on selection of grasses and care the lawn. Many old wives' tales are sted in the "More Fancy than Fact" sec-n that concludes each chapter.

ound Covers for Easier Gardening. Daniel Foley. 224 pages, illustrated, partly in or. Chilton, Philadelphia. $5.50.

Many herbaceous and woody plants, both ct and trailing, are suggested as attrac-e substitutes for grass in difficult places.

Are You Your Garden's Worst Pest? Cynthia Westcott. 305 pages, illustrated. Doubleday, Garden City, N. Y. $4.50.

A refreshing and practical approach to the proper care of one's plants.

Vegetable Gardening. 72 pages (8½ x 11), illustrated mostly with line drawings. Sunset Books, Lane, Menlo Park, Calif. $1.50, paper.

Regional considerations given for culture of each vegetable. Complete directions with many helpful hints. Herbs included; also cooking charts and freezing techniques.

How to Grow Vegetables and Flowers by Organic Gardening Methods. J. I. Rodale and Staff. 926 pages, illus. Rodale Books, Emmaus, Pa. $7.95; deluxe edition, $12.50.

Detailed directions are given for the care of herbs, vegetables, and northern and tropical fruits.

Your Garden Soil, How to Make the Most of It. R. Milton Carleton. 170 pages, illustrated. Van Nostrand, Princeton. $3.95.

Reasons behind procedures in improving soil are given with extraordinary clarity.

Indoor Gardening

Greenhouse Gardening as a Hobby. James Underwood Crockett. 288 pages, 16 in color. Doubleday, Garden City, N. Y. $4.95.

The kinds of greenhouses and their furnishings, climate control, soils, fertilizers, and other aspects of culture are presented. Plants to grow are treated in groups (cut flowers, cacti, ferns, orchids, and such). A month-by-month chart tells what to do.

The Encyclopedia of House Plants. Dorothy H. Jenkins. 328 pages. Bantam, New York. 95 cents, paper.

Alphabetical entries within the chapters give information on a wide assortment of plants for indoor culture. Separate chapters deal with uses (such as room dividers), general culture, and upkeep, by the calendar.

Arts, Crafts and Hobbies

New Horizons in Flower Arrangement. Myra J. Brooks, with Mary Alice and John P. Roche. Foreword by Helen Hull. 192 pages (8½ x 11), 18 in color. Barrows, New York. $10.

The authors, seeking new ideas in distant places, show original combinations of

material with accessories by skilled artists and craftsmen. Family treasures, whether or not of intrinsic value, are cleverly worked into some of the compositions.

Japanese Floral Art. Rachael E. Carr. 377 pages, illustrated partly in color. Van Nostrand, Princeton. $12.50.

Symbolism, culture, and practice of Ikebana by an accomplished student of leading Japanese schools.

Ikebana, The Japanese Art of Flower Arrangement. Hiroshi Ohchi. 124 pages, many photographs, some in color. Hastings House, New York. $5.95.

Prepared with the assistance of the Ikenobo Institute of Flower Arrangement, Tokyo. Parallel columns give the text in German and in English.

Arts and Crafts for Flower Arrangements. Kathryn Holley Seibel. 202 pages, illustrated. Van Nostrand, Princeton. $5.95.

An extension of flower arrangement into the fashioning of accessories and equipment.

Art Principles of Flower Arrangement. Clarice T. Wilson. 111 pages, illustrated. National Council Books, Box 4965, Philadelphia, Pa. $5.

A reprint of an early basic work.

Gifts from the Garden. Suzanne James. 130 pages, illustrated. Hearthside, New York. $4.50.

Useful and attractive items that can be made from plants in the average home garden.

Lichens for Vegetable Dyeing. Eileen M. Bolton. 63 pages, 61 color illustrations. C. T. Branford Co., Newton Centre, Mass. $3.50.

An ancient craft explained for present-day users.

Driftwood in the Home. Florence M. Schaffer. 128 pages, illustrated. Hearthside, New York. $3.95.

How to make weather-worn wood the basis of decorative pieces, including flower arrangements.

A Second Treasury of Christmas Decorations. Beth Hemingway. 128 pages, 90 photographs. Hearthside, New York. $3.95.

How to make traditional and modern, outdoor and indoor decorations for the home.

Growing for Showing. Rudy J. Favretti. 147 pages, illustrated. Doubleday, Garden City, N. Y. $3.95.

A guidebook for the amateur exhibitor of living plants.

Flower Painting. John FitzMaurice Mills. 90 pages, illustrated. Pitman, New York. $6.95.

Some techniques for students and amateurs to master.

Flower Painting, Its Art and Technique. Countess Maria Zichy. 109 pages, illustrated, partly in color. Watson Guptill, New York $9.75.

General instruction in oil painting and in composition. Notes also given on painting with watercolor, pastel, and casein.

Roses; Growing for Exhibiting. Harold A. Allen. 175 pages, drawings by author. Van Nostrand, Princeton. $4.95.

Directions for preparing flowers for exhibition are specific, and none sound difficult to follow toward awards.

Picture Books

The Wonderful World of Flowers. Paul Jaeger. Translated from the French by J. P. M. Brenan. 195 pages (7 x 10), illustrated. Dutton, New York. $15.

Enlarged photographs of flowers and flower parts, mostly richly colored. Text gives technical information on floral movements and how they are affected by temperature, light, shock and moisture, and on methods of fertilization by wind, water, insects, birds and mammals, among other topics.

Plant Marvels in Minature; a Photographic Study. Coenraad Postma. Foreword by Edwin Way Teale. 173 pages (10 x 12), chiefly illustrations. John Day, New York. $12.50.

Intricate detail is shown in photomicrographs of plant parts such as a leaf section magnified 300 times, two nettle stingers, a pine needle cross section, each occupying a full page.

Designs in Nature. Tet von Borsig. Introduction by Adolf Portmann. Translated from the German by Cynthia Harris. 80 pages. A Studio book. Viking, New York. $6.95.

Leaves, buds, and other parts of plants are shown in exquisite detail in 80 photographs.

Italian Gardens. Georgina Masson. 300 pages illustrated. Harry N. Abrams, New York $17.50.

The 123 plates (2 in color), with maps illustrate and locate historical and beautiful gardens still existing in Italy.

Plants in the Wild

ldflowers of North America. Robert S. amon and Charles C. Johnson. 280 pages, color plates. Hanover House, Garden , N. Y. $7.95.

lowers of separate areas around the ntry—the coastal regions, southwestern rts, mountains, prairies, and woodlands re depicted in vivid color. The text, in versational style, is brief. Botanical es must be sought in the index.

d Flowers. Homer D. House. 362 pages, color illustrations. Macmillan, New York. 95.

reissue with remade plates but un- ged text. Originally "Wild Flowers of York."

ual of the Trees of North America (ex- ive of Mexico). Charles Sprague Sargent. pages, 783 illustrations. Dover, New . Two volumes, each $2, paper.

reprint of a historic work of 1905.

en Handbook. Mason E. Hale, Jr. 178 s, illustrated. Smithsonian Institution, hington, D. C. $4.

sic information on lichen form, struc- reproduction, growth, and chemistry, on distribution and uses. Species de- ed are found in eastern North America.

Guide. Edgar T. Wherry. 318 pages, rated by J. C. W. Chen. Doubleday, en City, N. Y. $3.95.

neat, compact, useful book, describing pecies of ferns and fern relatives, and g a brief cultural note wherever ap- iate.

eral Reading and Reference

Garden Heritage. Alice Sloane Ander- editor. 622 pages. Dodd, Mead, New . $12.50.

m this selection of articles from the *tin* of the Garden Club of America there es the impression of a publication of icance. Many of the country's lead- orticulturists and a number of promi- botanists have contributed to its pages.

and People. Charles Morrow Wilson. ages, end-paper photographs. Univer- f Florida Press, Gainesville. $6.50.

Agriculture, economics, social history, agronomy, conservation, personal experience, and anecdote are here combined into a picturesque account of the usefulness of the grasses.

Mark Catesby; the Colonial Audubon. George Frederick Frick and Raymond Phineas Stearns. 137 pages, 16 plates. University of Illinois Press, Urbana. $5.

A new appreciation of an important 18th century naturalist, about whose personal life very little has ever been known.

National Plant Conservation Guide. Ethel Magwood Burns. National Council Books, 6753 Germantown Ave., Philadelphia, Pa. $3.

Names all plants on the preservation lists of each state.

Yearbooks

Seeds. The Yearbook of Agriculture 1961. Alfred Stefferud, editor. 591 pages, illustrated. The United States Department of Agriculture, Washington 25, D.C. $2.

The six sections of the book on the importance, life processes, production, processing, certification, and testing of seeds contain good general reading (such as "How Long Can a Seed Remain Alive?") and a great deal of important reading for agriculturists, foresters, nurserymen, gardeners, nature-lovers, and students. Photographs show many steps in seed production and processing.

American Camellia Yearbook 1961. Joseph H. Pyron, editor. 335 pages, 8 color plates. American Camellia Society, Tifton, Ga. $5.

Camellias in foreign lands, camellia hybrids, research, and new introductions are among the topics covered.

American Rose Annual 1961. James P. Gurney, editor. 243 pages. American Rose Society, 4048 Roselea Place, Columbus 14, Ohio. $4.50.

Roses as an integral part of the home landscape are one of many stimulating articles in this annual guide.

The American Daffodil Yearbook 1962. Gertrude Smith Wister, editor. 120 pages. American Daffodil Society, Inc. Mrs. E. J. Adams, Secretary, Huntington, W. Va. $1.25.

Nearly a score of good articles, mostly on culture, breeding, and kinds of daffodils.

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